Economics of Group System for Street Lighting
—Operation of Wood-Burning Generating Station and the regular departments.

Electrical World

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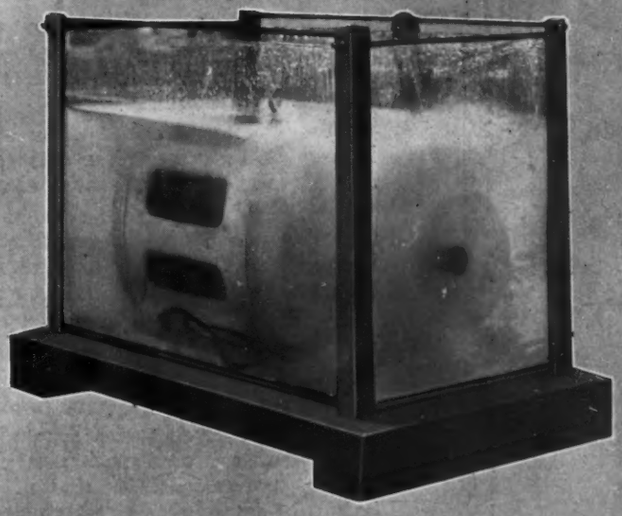

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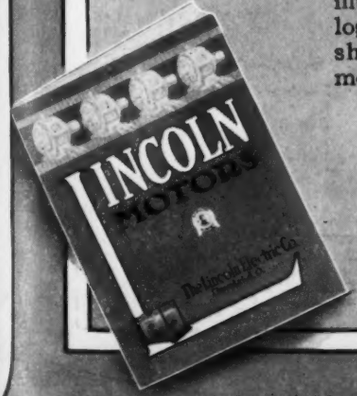

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Electrical World

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Work of the Contractors' Association

NO more definitely useful service has been rendered by the National Electrical Contractors' Association to the electrical industry and to the general public than its work in outlining and compiling desirable laws for the licensing of electrical contractors, and in encouraging the enactment of adequate licensing measures by states and municipalities. Such measures strike directly at the source of improper and unsafe wiring, for they insure that electrical work shall be done by qualified and responsible workmen. Moreover, state-wide licensing will minimize the element of politics and extend protection to outlying communities which now have little or no electrical inspection. Care must be taken, however, that no law in its operation will restrict the open field of legitimate electrical contracting work against any who are fully qualified to do electrical work.

Co-operation in the association to meet the practical problems of the business has resulted also in a plan of mutual liability insurance, which during the year has resulted in marked savings for the members of the association. The contractor is a creative force in the industry. His business makes possible the utilization of electricity. Apart from the very practical side of seeking to establish uniformity in cost keeping, so that members will not bid without including a profit to themselves, and in otherwise raising the standards of doing business, the National Electrical Contractors' Association stands for the advance of one of the most important branches of the industry and deserves the support of every individual contractor.

Southern Floods and Electrical Supply

THE floods which swept over a large portion of the Southeastern states this week would have seriously crippled a great part of the transmission systems in that section were they not interconnected. Although on one river alone 100,000 hp. of electrical generating equipment is still being dried out, the mills able to operate are receiving energy from the same lines, but generated at other sources. This provides an excellent demonstration of the advantages of interconnected systems to meet such a sudden emergency like that occasioned by the unprecedented floods in the Southern Appalachian region. The streams in that region, with but few exceptions, fall in gradual descent from their mountain sources to the fall line. The aggregate fall from the sources of streams to the sea is large but, unfortunately, too gradual to produce power cheap to develop or free from danger of backwater. Another singular peculiarity of the Appalachian region is the absence of lakes, so that from end to end of the main chain there is practically no natural storage whatsoever. The prevailing hydroelectrical developments comprise a dam at the most favorable location on the stream which backs water over a succession of three or four shoals and thus secures a head at the point of development usually between the limits of 35 ft. and 50 ft.

As previously pointed out in these columns, six of the great transmission systems covering the states of North Carolina, South Carolina, northern Georgia and a part of Tennessee are now actually in physical connection through various traffic arrangements. While the Southern Power Company, which bore the brunt of the flood, was able to operate its many steam reserve stations, it was also able to receive energy from the transmission systems north and south. Although the surplus output of all the other plants was at its disposal, it speaks well for the system that it did not ask for more than the usual amount of power which it ordinarily receives through interconnection. However, with complete interconnection and friendly traffic relations as long as the steel tower transmission lines remained standing, the company could have supplied its customers from energy received entirely from other systems.

A Group Street Lighting System

THE brief paper by Ferry and Tompkins on the development of a group scheme of street lighting in Chicago contains data which may prove valuable elsewhere. The plan followed has for its fundamental idea the evolution of a series system in which the transformer units shall be of favorable size and the high-tension cable reduced to a minimum. In carrying it out the service wiring is divided into group circuits of perhaps a score of lamps each, taking consequently only about 400 volts, while each group is fed from a single transformer on the main series. The result is much lessened danger from high-tension wiring, better transformer efficiency, and above all considerably decreased cost in installation. Moreover, on the whole, reliability is increased from the great decrease in high voltage wiring for the same amount of service. The countervailing disadvantage is the necessity for special protection for each lamp of each group so that one failure may not put the other lamps out of business. This protection takes the form of the film cut-out socket well known in the art and seems to be sufficiently successful. This adds an item of expense which, however, is much more than compensated by the abolition of the small individual trans-

formers. Careful estimates show that the net result of the group arrangement is a large saving in capital charges, depending somewhat on the arrangement of the circuits as respects the amount of high tension cables which must be run. Roughly, the gain per lamp installed seems to run from 15 to 30 per cent. The effect on up-keep cannot yet be well determined, but it should be very material, especially in overhead districts where the menace of trees is continually before the operator. A few years of experience will tell the whole story, but at the start the project looks promising and deserves a thorough trial. Distribution at high potential is a necessary evil and when it can be relieved by any economical modification both costs and service are likely to be bettered.

Where Wood Still Grows

IN most sections of the country firing a power plant with wood would seem about as wasteful as winding its machines with silver wire. But to remind us that forests still remain and that somewhere still a real lumber industry flourishes comes the tale of the station at Springfield, Ore., which thrives on the waste product of a great adjacent sawmill to which it, in turn, furnishes power. There are still a few wood-burning plants in the South and West, burning refuse or otherwise unmarketable stuff, and the one here described represents the most logical sort of utilization of fuel. It is a case where a lumber company needs power and produces regularly an immense amount of waste sawdust, shavings and scraps which must in some fashion be put out of the way. As the local central station was practically next door it was a very simple matter to arrange a barter of fuel for steam and electric power which seems to result well for both the parties concerned. The essential features are a reciprocal contract based on power generated by the fuel and that taken back by the motors, and a contract for steam supply for kilns and auxiliaries. A minimum provision for fuel and energy consumed safeguards the station as to amount of service. The mill requires a good proportion of the power generated, and while this is supplied for a nominal profit the net result is a considerable saving since the wood waste gives a very much lower cost of fuel than would coal even under very favorable conditions. In fact, the fuel cost is down to 5 mills per kilowatt-hour, a figure that might well be envied by stations ten times the size and not far from coal supply at that. In very few parts of the country do similar situations exist, yet wherever there is a lumber milling industry large enough to furnish a big and continuous supply of refuse wood the matter is well worth looking into. The refuse must be burned anyhow, and better under boilers than in the open. Now and then a water-power plant may find such a source of supply for an auxiliary, since the mills work very actively in the months of low water if they do not have to depend on it for power. The game is well worth the candle wherever the candle can be found.

Pure Science and Industrial Research

THE presidential address of Dr. J. J. Carty at the Cleveland A. I. E. E. convention on the above topic is a clean, forceful and timely contribution to engineering literature. We recommend it to our readers. It is remarkable that the world war should have been so great an object lesson on the importance of applied science. All nations, combatant and neutral alike, have come to see that modern warfare can only be successfully carried on by means of a vast industrial organization, a machinery army operated by men behind the machines, for the production of the most advanced destructive implements. In future, no rebellion can hope to succeed without the support of a host of organized machine shops, as well as a host of trained men. A new and developed warlike invention may be worth more than an army corps.

But in the more normal and less brutal struggle of peace, the worldwide industrial and economic contest, success and victory comes just as surely to the peoples who organize and work earnestly and scientifically, as in war. There is no hope for the nation that does not apply organized intelligence and hard work to its production. The organized intelligence involves the application of mathematics, physics, chemistry and economics to the common sense of industrial work. New problems are constantly arising, and their economic solutions call for the best brains, knowledge and training that can be mustered. This is but another way of describing the need of the application of science to industry.

In this great field of usefulness, there are many branches and also many successive concentric zones of utility, all the way from the improvement of science, untinctured with any suggestion of industrial needs, to the betterment of industrial technique, unrestricted by any needs for enriching scientific literature. Between these two limits lie a host of intermediate zones for useful development. The universities naturally take the lead in the purely scientific end of the range, partly because their business is to maintain and to transmit a proper knowledge of the sciences, and partly because what they discover they must publish. It is very difficult for the university or the technical college to undertake strictly industrial research, because industrial improvements are necessarily either patented or concealed, as far as possible, from the eyes of competitors, and the spirit of concealment of knowledge is foreign to the whole theory of teaching and learning. But the universities can and do train the young men who go out to work in all the zones and branches of industry. It is not necessary for success in an industry that its leaders should be university men. The necessary knowledge of science, economics and business can be learned, by sufficient effort, alone; but it is the business of the modern university to foster, instigate and disseminate the knowledge of these things. They provide the atmosphere of patient inquiry and earnest research, before which all practical problems must eventually yield their solutions.

It fortunately happens that in the great variety of gifts and natural endowment, individuals differ so widely that they naturally scatter into different zones and branches of work. Some men are gifted as salesmen, others as operatives, others again as organizers or executives, others as inventors or engineers or designers or investigators; but there is ample work for all types, if the work is properly organized and co-ordinated. The Carty paper emphasizes the importance of setting scientifically trained men to work, in a systematic way, at industrial problems, and all nations are beginning to learn the vital importance of this procedure.

Screens for the Movies

ON first thought it might be supposed that one screen for the projection of moving pictures is very much like another, and that the only problem in providing one is to get a good diffusing surface reflecting a large amount of light. The section of Mr. McOmber's article in this issue on the lighting of the moving picture theater gives this preconceived notion a severe jolt. In the case cited it took no inconsiderable amount of carefully carried-out scientific engineering to determine just what screen would give the best results for the audience, and what is of particular interest, it turned out that the best screen for one theater will by no means necessarily be the best for another, inasmuch as the viewing space may differ radically in shape in two auditoriums of similar seating capacity. To the technical photometrist this fact will be no surprise, and the need of the careful and skillful investigation in this case becomes fairly evident. Whenever a beam of light is projected against a diffusely reflecting surface the light turned back is not uniform in all directions. If one conceives of the ray as striking the screen normally, he can picture to his mind not a distribution curve reaching backward from the screen, but a surface of revolution the radius from every point of which to the center of the small diffusing area represents the relative illumination at that point. Some surfaces have a grain so that the illumination surface thus defined would no longer be a surface of revolution, but would be flattened in one axis or another. If the light does not strike the screen normally the surface will always thus be unsymmetrical around the axis of the beam. The main problem then is to select a screen so that the illumination reaching the eyes of the audience in a plane intersecting the surface of illumination shall be as strong and uniform as the conditions require.

In trying out various screens in the particular instance reported by Mr. McOmber, most of them were found to be rather poor from the standpoint of uniformity, while two among the list stood out as preeminently the best. One was an exceedingly good diffusing screen from the standpoint of Lambert's law, while the other embodied a wide departure from this law. The latter screen was a pure white surface covered with minute glass globules. The curves given in the paper show immediately the results from these two interesting types of screen. The first was technically the better diffuser, but it diffused too well for the form of the auditorium, although the brightness of the screen was remarkably uniform as seen from various parts of the house. It threw a good deal of light clear away from the area occupied by the audience. This light, striking the walls, turned up as diffused light strong enough somewhat to veil the brilliancy of the picture on the screen. The second type gave a distribution which fitted the shape of the auditorium very much better, with excellent viewing qualities throughout, and exceptionally good in the back of the house. The comparatively small amount of rays wasted laterally lessened any tendency to veil the pictures by diffused light. The light reflected from this screen being more concentrated axially than that from the other, it was possible to get with it a picture of equal brightness even in the rear of the house with only about half the illumination on the screen. By thus cutting down the diffused light, and placing the directly reflected light where it was needed in the auditorium, an exceedingly satisfactory result was achieved, and one particularly pleasing to the eyes of the audience, since it secured the maximum visibility with the minimum of unnecessary brilliancy in and about the house. The problems outlined were worked out by accurate photometric measurements of the distribution of light produced by a brilliant spot thrown on the screen, and the result is a beautiful demonstration of the value of technical precision in dealing with conditions which at first thought seem almost commonplace.

The Coming Issues

NEXT week, in the issue of the ELECTRICAL WORLD dated July 29, a leading engineering article will be devoted to an account of a district steam-heating system which pays a net income of more than 8 cents on each 1000 lb. of steam sold. Opinion as to the desirability and profitable character of steam heating in connection with an electric generating system has been rather divided in recent years. In the plant referred to, however, the adaptations made have put the heating business firmly on a paying basis and may offer hints from which other managers can benefit in the way of securing operation at greater profit. A second article in the same number will tell of how one great interconnected central station system, realizing its commercial opportunities, has made each one of its employees a scout for new business and potential contracts for service. In the public policy number for August, the first issue of that month, one of the principal articles will deal with the investment involved in superseded equipment, and another will discuss the broad subject of co-operation in the industry. Continuing the usual schedule, the second issue of the month will be the station operating number, the third issue the engineering number, and the fourth issue the number devoted largely to the broad commercial phases of the electrical industry. In the foregoing connection attention is called to the first number of ELECTRICAL MERCHANDISING, just published, which extends to the trade the editorial service of the ELECTRICAL WORLD.

Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

CONTRACTORS AT NEW YORK

Convention of National Association Discusses Concentric Wiring and Insurance Topics

With an attendance of more than 300 electrical contractors drawn from all parts of the United States, including the Pacific Coast, the sixteenth annual convention of the National Electrical Contractors' Association was held at the Hotel McAlpin, New York City, from Monday to Saturday of this week.

Aside from the executive meetings for members only, several of the sessions devoted to general topics, concentric wiring, and insurance matters were thrown open to all. During the convention an exhibit of appliances and wiring supplies by manufacturers and jobbers was held in the first floor grill room of the hotel.

Lewis H. Woods, president of the New York State Electrical Contractors' Association, opened the first regular session of Wednesday morning with an address of welcome, to which an eloquent response was made by John R. Galloway, the president of the National association.

SHOULDER TO SHOULDER WITH THE CENTRAL STATION

T. Commerford Martin, executive secretary of the National Electric Light Association followed with an address in which he pointed out how the central stations and electrical contractors have worked side by side in bringing about the present great growth of the electrical industry, which for the last twenty-five years has been making annual increases of 15 to 20 per cent, until to-day the central station companies have a total income of more than $450,000,000 a year. Mr. Martin referred to the common opportunity before both contractors and central stations in the large number of houses which still remain to be wired. He cited statistics to show that the central stations of America are now spending from $2,000,000 to $3,000,000 a year to teach the public the desirability and convenience of electricity—educational work in the commercial results of which the electrical contractor shares.

Arthur Williams of the New York Edison Company, who followed, emphasized the fact that the electrical contractors are very largely the custodians of the good name of the electrical industry, for they form the link which connects the public and the industry. Public opinion with respect to that industry, he said, rests nowhere more heavily than on the electrical contractor. Not only the reputation of the local electrical utility company, but the volume of its business as well, depends to a large extent upon the electrical contractors.

Edward Trefz, secretary of the Chamber of Commerce of the United States, Washington, D. C., made an eloquent address pointing out the importance of more adequate representation of business men in the making of the nation's laws. He urged that the National Electrical Contractor's Association join with and indorse the Washington organization in its work.

H. W. Alexander of the Society for Electrical Development, Inc., followed with a talk on the plans for America's Electrical Week and its meaning for the contractor.

At the open meeting of Thursday morning, to which contractors, manufacturers and others of the electrical industry were invited, particular interest centered about the discussion of the subjects of insurance and concentric wiring. Joseph A. Fowler, chairman of the insurance committee, presented his report, which was followed by an address by L. T. Block, manager of the Utilities Indemnity Exchange, St. Louis. Earnest McCleary of Detroit, Mich., presented his report as chairman of the committee on the national electrical code. This report was followed by discussion of the subject of concentric wiring, model installations of which had been shown during the week in the exhibit hall below.

DISCUSSION ON CONCENTRIC WIRING

After explaining committee procedure Mr. McCleary urged that the contractors approach the subject of concentric wiring frankly, honestly and with open minds. J. R. Strong, who opened the discussion, outlined the history of the concentric-wiring movement. American trial installations thus far, are in his opinion, crude and of doubtful economy and safety. He declared that the economies expected might be more simply attained by a bare grounded-return system. H. R. Sergeant, Schenectady, N. Y., described the changes made in adapting European concentric conductor to American requirements, and pointed out that if by such cheaper construction houses now unwired can be reached, the contractors will have just so much more business handed to them "on a platter." During the discussion the elimination of the minimum monthly bill was urged by several speakers as a factor which might be more useful than cheaper wiring in securing business from humble homes. R. S. Hale of the Boston Edison Company, indorsed Mr. Strong's statement that the concentric-wiring feature is but a part of the much broader movement toward cheapening electrical construction, and he made a plea for constructive suggestions concerning concentric or other forms of wiring that will effect progress toward that end.

At the meeting of the board of directors, held on Tuesday morning and afternoon Secretary Duffield reported that the work of the association in attempting to discourage the sale of electrical supplies to 5 and 10-cent stores by electrical manufacturers has borne fruit, and several instances were cited in which manufacturers have ceased this practice.

OFFICERS FOR NEXT YEAR

The nominating committee presented a report nominating the following officers for the next year, subject to confirmation by the vote of the association on Friday.

President, Robley S. Stearnes, New Orleans, La.; first vice-president, W. K. Tuohey, Springfield, Mass.; second vice-president, J. C. Rendler, Los Angeles, Cal.; third vice-president, J. T. Marron, Rock Island, Ill.; treasurer, James S. Hilton, Syracuse, N. Y.; secretary, George H. Duffield, Utica, N. Y., and sergeant-at-arms, James F. Burns, Schenectady, N. Y.

NEW ORLEANS IN OCTOBER, 1917

The date of the 1917 convention of the contractors' association, which is to be held at New Orleans, has been changed to the week of Oct. 10, 1917, so as not to conflict with the convention of the Jovian Order, which is to be held during the third week in October, the time that had been previously set for the contractors' meeting.

SOUTHERN FLOODS AND HURRICANE

Record High Water Floods Hydroelectric Stations and Industrial Plants in Southeastern States

A devastating flood, equal in all its fierceness to any that has visited the Ohio or Mississippi valleys, swept through the Piedmont section of the Carolinas last Saturday, Sunday and Monday, July 15, 16 and 17. The flood was the result of a hurricane over the Southern Atlantic coast Thursday night, Friday and Saturday accompanied with cloudbursts. The area that has felt the effects extends from eastern Tennessee, through southeastern West Virginia, southeastern Virginia across North Carolina roughly to Wilmington and embraces virtually all of South Carolina. Through these sections flow the French Broad River, the Broad River, the Catawba River and the Yadkin River, on all of which are located hydroelectric plants supplying hundreds of cotton mills, industrial plants and towns with electric light and power. The flood on the Catawba River was the greatest on record, not a bridge, telephone, telegraph or power wire being left practically from its source to its mouth. The maximum rise opposite Charlotte, N. C., on Sunday was 50 ft. above normal.

Five water plants of the Southern Power Company, aggregating more than 125,000 kw. rating, and two steam plants of a total rating of 18,000 kw., are located on the Catawba River and were seriously affected by water flooding the operating floors and causing shutdowns. As shown on the accompanying map, the plants of the Southern Power Company are located one above the other so that the flood condition of the river affected all. The floor reached its crest at the upper plant on the Catawba River at Lookout Shoals, near Statesville, on Sunday morning; at Mount Holly, the site of a 10,000-kw. steam plant, on Sunday night; at the Catawba station shortly after noon Monday and at Great Falls, and Rocky Creek stations, the last of the chain, at about 6 o'clock Monday night. The Great Falls station, which was reported free from water at this time, became flooded and was forced to drop the load it had so successfully carried during the period the water was rising in the plants higher up the river. Although it was necessary to curtail service to mills using energy under secondary service contracts, on Wednesday all primary power customers were being supplied except those on lines which had been crippled by loss of river crossings. It was expected, according to reports Wednesday night, to have river crossings complete so as to make power available on all lines. Power was taken from hydroelectric and steam plants not seriously affected during the flood crest so that the energy taken Wednesday from the Tallulah Falls station of the Georgia Railway and Power Company, where connection is made, was not more than is usually taken from this plant.

EFFECT OF FLOOD ON SOUTHERN POWER COMPANY'S STATIONS

Water was out of the power house at Lookout Shoals, 12 miles north of Statesville and 54 miles from Charlotte, and rapidly receding early Monday morning. It was gradually diminishing in the steam plant at Mount Holly later in the day and at the Catawba station near Rock Hill shortly after the noon hour. The same condition existed Monday morning at Ninety-nine Islands on the Broad River, 15 miles south of Gaffney, S. C. The water there got up on the generators but not to the bearings, rising about 30 in. in the station. The damage was not great and the plant will be in condition to operate in a few days. The great flood stress was at its maximum at Fishing

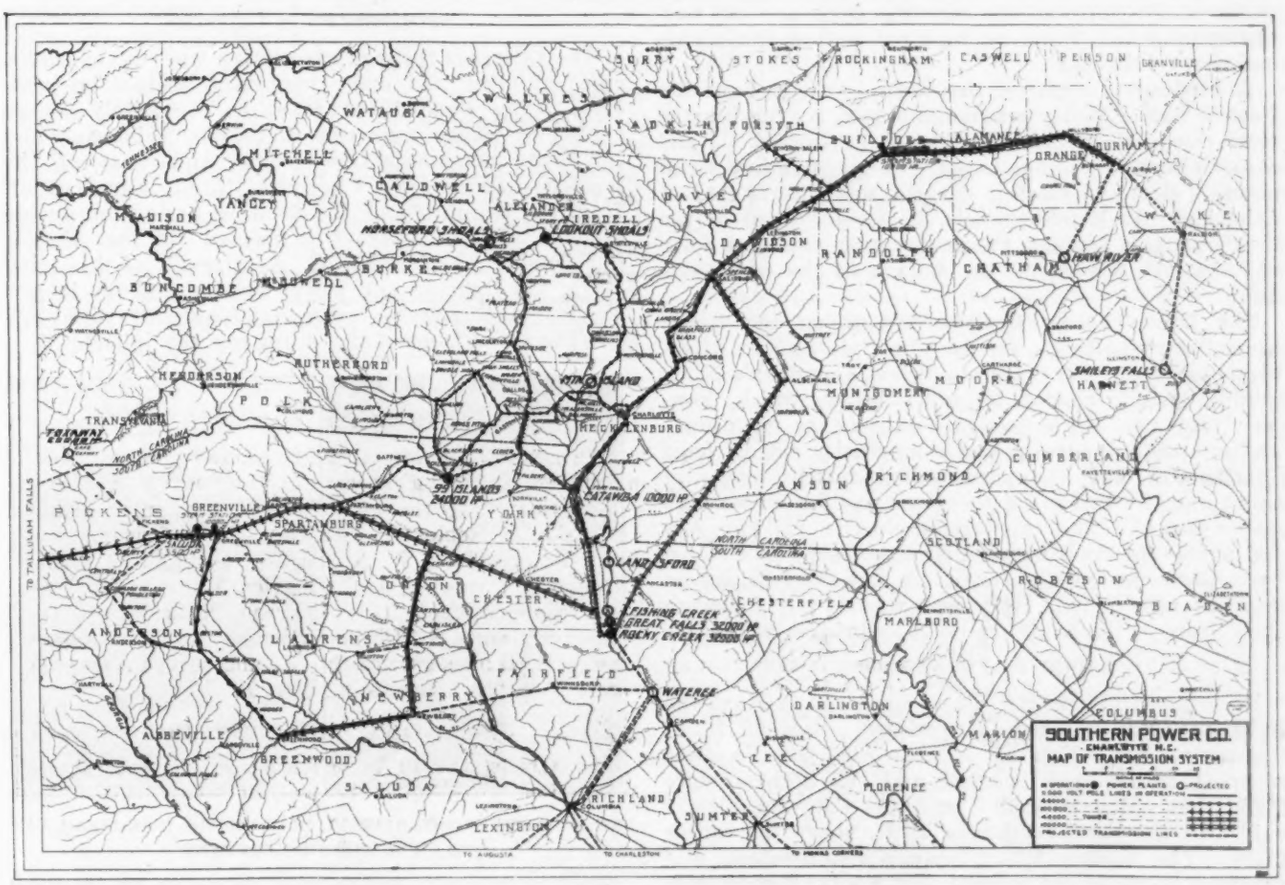


FIG. 1—WATER POWER PLANTS AND TRANSMISSION LINES IN NORTH AND SOUTH CAROLINA AFFECTED BY FLOOD AND HURRICANE SUNDAY AND MONDAY OF THIS WEEK

FIG. 2—GREAT FALLS PLANT OF THE SOUTHERN POWER COMPANY, THE LAST OF A CHAIN OF FIVE STATIONS ON THE CATAWBA RIVER WHICH WERE FLOODED BY THE HIGHEST WATER ON RECORD

Creek, Great Falls and Rocky Creek stations, about 12 miles down the Catawba from Chester, S. C., late Monday afternoon. Three miles above Great Falls station, where Fishing Creek enters the river, a dam and power house with practically all of the hydro-electric machinery in place, would have been turned over to the Southern Power Company by the Hardaway Contracting Company, the builders, the latter part of next month. This station has a rating of 40,000 horsepower. The Hardaway Contracting Company suffered heavily by damage to equipment valued at more than $100,000 on the job and a good part of which was in the path of the Catawba River torrent. The water at the Catawba station is said to have reached the top of the windows in the power house. At Lookout the heaviest damage was sustained at the outdoor sub-station which steps up from 6600 volts to 44,000 volts, for transmission. The damage to the power house proper was only slight. When the machines have been dried out and washed they will be started up again. The damages at Catawba and at Ninety-nine Island stations are said to be slight. At both the Lookout Shoals and Catawba stations the water washed around the concrete dams and cut new channels, which must be repaired before the plants can carry full load.

According to reports, the rainfall throughout the French Broad Valley was from 6 to 8 in., forcing the river out of its course, flooding Asheville, N. C., and causing serious damage to some twenty-five industrial plants. Gas and electric service was interrupted at Asheville. At Hendersonville, N. C., the plant of the Hendersonville Light & Power Company was shut down and the city flooded by the failure of the company's dam.

The Dravo Power Company's dam on the Broad River, near Shelby, N. C., went out late Sunday afternoon, menacing the Southern Power Company's Ninety-nine Islands station 20 miles below, which, however, did not suffer serious damage as mentioned above, although service was temporarily cut off from Spartanburg and the surrounding textile towns at this time. At this point the river was far above high water record. The interurban electric railway was tied up by the flood between Spartanburg and Greensboro, Gastonia and Charlotte. A new steel bridge on this line near Mount Holly was washed out following the failure of the Southern Railway bridge just above.

HIGH WATER RECORDS

Reports state that the Kanawha River at Kanawha Falls was 31.7 ft. above normal and about 38 ft. at Charleston. The New River near Roanoke, Va., was reported 30 ft. above normal and the highest since 1878. At Mount Holly on the Catawba, it is said that the flood crest was 47 ft. above low water mark. The Yadkin River, near Winston-Salem, was reported 25 ft. above normal and 8.5 ft. higher than the record for the past forty-five years. Near Salisbury the Yadkin at noon Sunday was 21 ft. above normal and 4 ft. higher than previous record. It is said in one report that although several large derricks were lost on the dam construction work of the Aluminum Company of America at Baden on the Yadkin, no serious damage was done to the dam thus far constructed mainly for the reason that it has only been built to the edge of the stream on each side and was not subjected to any great pressure from the flood. The Blewett Falls plant on the Yadkin is said to have escaped damage.

The Parr Shoals plant of the Parr Shoals Power Company, 27 miles above Columbia, S. C., on the Broad River, was in operation during the flood period, and together with the local steam plant carried a large part of the load dropped by the water power plant in Columbia shown herewith partially submerged in an accompanying illustration.

Most of the flood water in the extreme western part of North Carolina and eastern Tennessee was taken off by the French Broad River so that Augusta plants on the Savannah River did not suffer as serious damage as was first expected. The crest at Augusta on Tuesday was 25 ft. above normal.

TRANSPORTATION CRIPPLED

The railroads through the section were heavy losers, miles of track and many important bridges on main lines being washed out so as to completely tie up traffic, or cause numerous detours. Telegraph and telephone communications south and west of the flooded district from Charlotte, N. C., were cut off from the beginning of the flooding period mainly on account of the destruction caused by the 60-mile hurricane that preceded it. As a result of this wind storm the lighting and power service and the trolley service in Charleston were out Thursday night before the seriousness of the storm was felt inland.

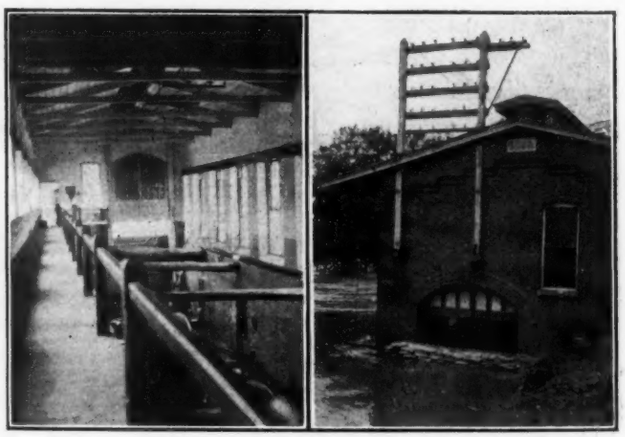


FIG. 3—WATER POWER STATION OF COLUMBIA (S. C.) RAILWAY GAS AND ELECTRIC COMPANY

Heavy timbers were used to brace the station wall on which river is pressing. Water was only 2 ft. below window sills outside and to bottom of machines from leaks in wall causing shut-down. Sand bags were used to hold water back from rushing into station whose operating floor was 25 ft. below.

Prosperity with the Electrical Manufacturers

Highly Favorable State of Business in the Industry Is Due, Says A. W. Berresford, to General Conditions, Which Justify Encouragement and Optimism in the Future

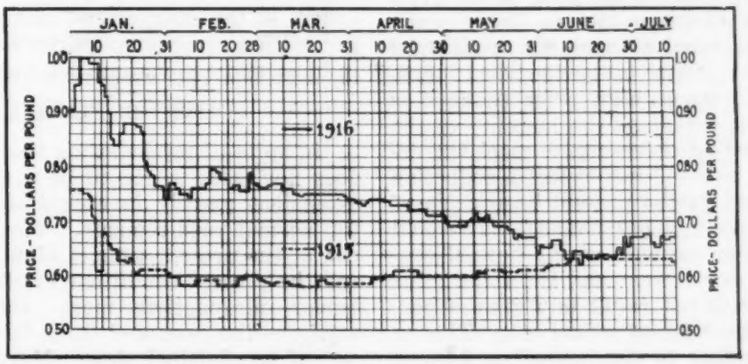
High costs of raw materials, difficulties in getting supplies, labor conditions and an unprecedented demand for products have brought real problems to the electrical manufacturer. The question of what effect these fundamental conditions will have on the future is a matter of deep concern to the whole industry. A. W. Berresford, whose conservative optimism is expressed frankly in this interview, is vice-president and general manager of the Cutler-Hammer Manufacturing Company. He is also president of the Electrical Manufacturers' Club, though it is as an individual manufacturer that he gives the interview to the ELECTRICAL WORLD.

TENTH IN A SERIES OF "TALKS IN THE INDUSTRY"

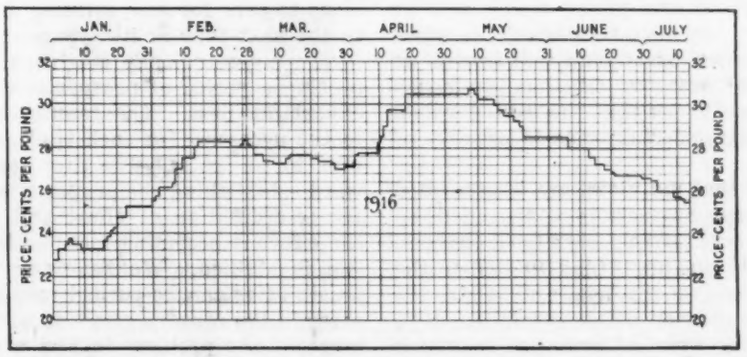
BY FREDERIC NICHOLAS

"THE electrical industry, so far as it relates to manufacture, produces what may be termed a secondary product," said Mr. Berresford. "It is essentially an engineering business and depends on the investment of capital for its prosperity. In other words, unless the producers of staple manufactured products are prosperous, there will be little demand for the machinery used by them in converting raw material into the finished product, and (omitting the munitions orders placed directly with electrical concerns, which while large in the aggregate have formed a comparatively small percentage of their productive capacity) the business placed has been induced by this prosperity of the manufacturers of staple goods.

"Because of this favorable general condition the electrical industry, in common with practically every other in this country, is enjoying a season of almost unbounded prosperity. While this condition has undoubtedly been influenced by the European war, I do not believe that influence is responsible for more than a comparatively small percentage of the business which is being taken. On the contrary, I feel that in any event we would have enjoyed better than normal business, and regard the business which has come, directly or indirectly, from European conditions as being the superimposed load which resulted in the placing of orders from last November to May of the present year at a rate which was in excess, usually, of the output capacity of the companies favored.



SHARP FLUCTUATIONS IN RAW MATERIAL COSTS CONTINUE—AVERAGE DAILY PRICES OF PARA RUBBER IN NEW YORK IN 1915 AND 1916



AVERAGE DAILY PRICES OF ELECTROLYTIC COPPER IN NEW YORK AND LONDON—1916

"My reason for this belief is that for a year prior to August, 1914, general business had been poor. The percentage of unemployed was comparatively large and the purchasing capacity of the country comparatively small. As a result, retail stocks of every character were reduced to a minimum, and in some lines of trade the shelves were practically bare. It was a buyer's market, and it was possible for the jobber or retailer to obtain what he needed practically without delay, and at low prices, so there was no incentive to stock.

"I believe that a change of marked degree was already in evidence in the summer of 1914, and that this would have made itself felt in the fall of that year had it not been for the outbreak of the European war. This produced an unprecedented disturbance in world conditions, an utter confusion in financial circles and an uncertainty as to the immediate future which made it impossible to predict or to act. As a result, the buying movement to replenish the stocks of the country was delayed for a period of at least six months, but when conditions were readjusted the belated movement started, and it started with an added impetus because of the confidence resultant on the placing of business with us from abroad, and the certainty that for a time at least a continuation of the placing of such business would be necessary. The immediate employment of labor together with the amounts received by the farming industry for its products provided a purchasing power within our own country for our manufactured products and put into effect the long-delayed buying movement.

"I can see no reason why this condition of prosperity should not exist for a period of at least two years and probably for four years longer. I do not refer to the

placing of business at the exaggerated rate which was in evidence from November, 1915, to May of the present year, but do refer to a condition of business averaging somewhat better than normal over the period mentioned and in every way healthy and remunerative in character. A reaction will probably occur at the close of the European war, since it is evident that so great a disturbing force can neither be set up nor removed without involving a readjustment of conditions, and during such a period of readjustment uncertainty always exists, together with the consequent curtailment of operations. I do not believe, however, that this would be as important as if the war should stop at the present time or if it had stopped at any time in the past. This belief is based on the fact that if the war continues until the fall or winter of 1917, as would seem at least probable at the moment, the warring nations will have developed their own productive capacity to an extent which will enable them to care for their own requirements, and little if any munitions orders will be placed in this country. We will undoubtedly be exporting a considerable amount of foodstuffs and staple products, but at prices more nearly in accordance with normal conditions than when these products were purchased on an emergency basis.

No Marked Decrease in Raw Material Costs

"Further, the market for raw materials in which this country has been an important producing factor in normal times should be helped rather than hurt after cessation of the war, due to the necessity for the replenishment of supplies by the nations affected, and this should offset to some extent the decreased demand for manufactured products which we might then be shipping out of the country.

"I do not look for any marked decrease in the price of raw material during the next two or three years. This should not be interpreted as applying to material which is considered raw material in the electrical industry, and in which the present high price charged is dictated to a considerable extent by the inability of the mill to produce to the extent necessary to meet the demand. To be concrete, I should not expect a reduction of more than 10 per cent in the present base price of copper (now about 26½ cents per pound), but would be surprised if a reduction to more nearly normal conditions of demand with consequent ability of the mills to meet requirements would not result in a greater percentage reduction in the cost of wire, etc. That a marked reduction is pending in the immediate future, however, I do not believe, and I can see little reason for hesitancy in the buying of raw material for at least the first six months of 1917 at the prices which will be quoted, say, in October. It may be possible to place orders on a somewhat lower basis than will prevail at that time by a policy of more or less hand-to-mouth buying, but it would seem to me that the saving would be more than offset by the uncertainty as to delivery of material.

"It may, of course, be that my views are exaggerated on this point, since our own business is so dependent on delivery, and since the comparatively high fixed charges, due to the nature of the business, tend to reduce the influence which an increase in material and labor cost exerts on the final selling price of the product. But, with the exception of the lines of material in which duplicate production is the dominant factor, I believe that this condition applies generally to the electrical industry by reason of its being inherently a business of engineering.

"In our own case, it is necessary for us to make contracts for general lines of material not later than in October of the year preceding that in which it is to be used, and to determine so far as may be possible at that time the general basis of production. In 1915 we estimated what would be necessary and contracted accordingly. In November and December, however, it became evident that we had considerably underestimated, and we immediately went into the market and purchased on the basis of a largely increased output. These purchases were practically completed by the middle of March, with the result that our average increased cost of material for the year 1916 will be in the neighborhood of 19 per cent. During the period from Oct. 1 of last year to March 1 of the present year, there had been an increase in labor cost of approximately 7 per cent, and the further increase made necessary since that time by current conditions indicate an average increase for the year of approximately 10 per cent. To offset this we have been obliged to make two increases in the price of our product. The first, amounting to 10 per cent, went into effect on March 1, and is consequently in effect for five-sixths of the year. The second—also 10 per cent—going into effect on July 15, is effective over approximately one-half of the year, giving an average increase of 14 per cent, which does not quite equal the additional expense to which we have been subjected.

"It has not been sufficient, however, simply to contract for material, but every effort has been essential to insure delivery at our plant. One instance which shows this was the shipment of some 80 tons of brass and copper from the Connecticut district by express at an added cost of approximately $4,000 for transportation alone.

"As a result of these measures we have been able in general to meet the calls for delivery upon us, although we are operating almost at capacity. To have operated at ultimate capacity would have required the placing of orders at the exaggerated rate for a month or two longer, with a consequent increase in the number of orders in hand and a somewhat lengthened shipping period.

Use the Plant Efficiently

"In spite of my belief as to extended prosperity, this does not seem to me to be a desirable time for plant extensions greatly in excess of those required to care for normal requirements. The cost of building material at the present time is high, as are also labor rates, and the present conditions existent in the labor market render interruptions more probable than would ordinarily be the case, and these in themselves increase the cost of the finished plant. Moreover, I believe that the excess capacity which is inherently present in any plant under the conditions of normal business should be sufficient to care for any extreme demand which may occur in the next four or five years.

"To my mind, one of the strongest reasons for expecting a period of prosperity is the development of an export business. The country is gradually awakening to the necessity for such trade, and of providing measures to secure it. The first steps have been taken toward establishing the proper relations, and the necessity for co-ordination of effort and co-operation in making the effort is becoming more and more clear as the problem is studied. We have the possibilities, and these possibilities can be turned into facts if every manufacturer in the country comes to a realization of the importance of the problem to him and devotes himself honestly and unselfishly to its solution.

Possibilities in the Export Trade

"At first sight, it might seem that the prospects of increased business to the electrical industry due to an increased export trade would mean a comparatively small percentage of increase in output, and this would

probably be true so far as direct export is concerned. It is not true, however, in so far as the indirect advantage of the industry is concerned, since the increased prosperity of manufacturers of staple lines will result in an increase of capital expenditure, of which the industry in its present state of development will obtain a considerable share, and the increased purchasing power of the general public will again tend to add to the capital investment. It is my feeling, therefore, that the steps which are now being taken looking to the establishment of proper relations with foreign countries, to the co-ordination of our own activities in relation to foreign trade, and the setting up of the machinery which will make this foreign trade possible, should receive hearty indorsement and active assistance from the electrical industry.

EFFECT OF WAR ON CANADIAN RELATIONS

"The difficulties to be met must not be, and are not being, underestimated. For instance, one effect of the war has been to bring England and her colonies into close touch. They are undoubtedly more closely united to-day than ever has been true in the past. The natural result of such a condition would be preferential trade arrangements between England and the colonies, and a disposition on the part of the colonies to purchase from the mother country whatever she can supply. This must have its effect on our Canadian relations.

"Furthermore, a substantially similar tendency must exist between England, France and Russia, by reason of their close association, and it is to be expected that Russia will turn naturally to England and France for the products which they will be in a position to supply, and in view of Russia's state of development and her practically unexploited natural resources the relation would seem economically proper.

GREAT POSSIBILITIES IN CO-OPERATION

"In spite of these conditions, however, and the intensive competition which is almost certain to follow the re-establishment of peaceful relations, there are great possibilities for the United States, provided the proper relations are established at this time, and that the industries of the country can be put on an efficient producing basis. By reason of the formation of the various manufacturers' organizations the electrical industry is unquestionably in a better position to co-operate effectively to-day than at any previous time in its history. I refer particularly to the Electric Power Club, the Associated Manufacturers of Electrical Supplies and the Electrical Manufacturers' Club. The first of these associations deals with questions of standardization, etc., of electrical apparatus; the second occupies a similar relation to the vast field of electrical supplies, and the Electrical Manufacturers' Club, made up as it is of the executives of practically all of the important organizations in the country equipped for the manufacture of electrical material, deals with the broad problems affecting the industry as a whole.

"A further step in the organization is the formation of the Electrical Manufacturers' Council, consisting of four representatives from each of the three organizations. To this council all questions of common interest are referred so that they may receive united consideration, and the report to the respective organizations carries back with it the weight due to such consideration. A notable instance of the character of subjects considered by the Electrical Manufacturers' Council is the present vital one of the possibilities of uniform cost accounting.

"Taken as a whole, therefore, the future looks bright to me, and while conservatism is always in order I can see no reason for apprehension."

CENTRAL STATIONS OF JAPAN

Government Statistics Show 1940 Plants in Japan to Be Generating Electrical Energy

The first central station in Japan was the Tokyo Electric Light Company, which in November, 1887, with one home-made seventy-five-lamp dynamo installed at Nihoubahi supplied the city of Tokyo with electric lighting. From that time on central stations in Japan continued to increase their electric power, and at the same time the method of transmitting power to a long distance was taken into consideration.

Toward the end of 1907 the Tokyo Electric Company established a hydroelectric power station at Komahashi, with a capacity of 15,000 kw., to transmit that power to Tokyo over a distance of 50 miles. In view of this successful development others have been contemplated at various places, taking advantage of the waterpower abundant in this country. Among them the enterprise of the Inawashiro Hydroelectric Company is the largest one ever established in Japan (described in the ELECTRICAL WORLD for June 19, 1915). In October, 1914, the company completed the work of the first hydroelectric generating station in the neighborhood of the Lake Inawashiro, the united capacity of which was 14,000 kw., transmitting the power to Tokyo over a distance of 140 miles at an extra-high tension of 115,000 volts. The plant now has six 10,000-hp. turbines.

In 1910 the Hydraulic Power Investigation Bureau, which was continued to 1913, was organized for the purpose of investigating hydraulic power to be utilized for generating electric power. The available hydraulic power in Japan estimated by the bureau reached 2,295,223 hp.

A statistical report of electrical plants at the end of 1914 has been issued. The report shows a total of 1940 stations generating electrical energy, of which 390 are central stations, twenty-four railway plants, forty-seven combined railway and central station plants, 1366 isolated plants, and the remainder official plants; 695 of the plants generate energy by water-power, 788 by steam, and 457 by gas. The total capacity in 1914 amounted to 608,554 kw., of which 341,809 kw. was in central station plants. The next largest was that of isolated plants, with a capacity of 140,022 kw. The capacity in water-power generating equipment is 366,243 kw., in steam equipment 217,967 kw., and in gas equipment 24,344 kw.

Out of a total of 22,669.6 miles of transmission lines, 21,908.8 miles was aerial line and 750.8 miles underground line.

The number of lighting customers was 2,966,085, of which number 2,903,208 were supplied at a flat rate, 35,723 at a metered rate and 27,155 by a combination flat and metered rate. Most of the incandescent lamps used in 1914 were of the carbon type. Of the total of 6,992,885 actually lighted, 4,150,847 were carbon filament lamps and the remainder metal filament lamps. But 1555 arc lamps were in service. The connected loads of the lamps amounted to 177,940 kw.

Power customers totaled 32,033, of which 22,565 were supplied on a flat rate and the remainder on a metered rate. The total horsepower connected in motors amounted to 148,702 hp. Other electric appliances having an aggregate power of 133,051 kw., were connected to the lines of the different companies. The large number of customers supplied on flat rate is noteworthy.

Paid up capital amounted to $230,177,620, the nominal capital being $289,080,240. Debentures and loans amounted to $49,348,707 and reserve amounted to $7,400,604. Revenue from electric lighting amounted to $18,630,850, and from power consumption the income was $6,990,681.

Conditions Under Which Oregon Company Burns Wood

An Unusual Contract that Gives the Oregon Power Company Cheap Fuel and the Booth-Kelly Lumber Company Low Priced Energy for a 2300-hp. Motor Equipment —Features of Installations

A CONTRACT of unusual nature and of mutual advantage to both parties is being successfully carried out by the Oregon Power Company and the Booth-Kelly Lumber Company of Springfield, Ore. The latter company operates a very large sawmill and planing mill, and by means of conveyor and blower systems, transmits a portion of its refuse wood to the adjacent plant of the central station company. The power company pays $0.005 per kilowatt-hour at the switchboard to the lumber company for all energy generated, and the lumber company in turn pays $0.009 per kilowatt-hour for the first 1,000,000 kw.-hr. used in each current year, and $0.008 per kilowatt-hour for all over this amount. The contract further calls for a minimum usage on the part of each party to the agreement. For instance, the power company agrees to purchase sufficient fuel to generate a minimum of 3,000,000 kw.-hr. per annum in excess of the amount used by the lumber company, and the latter agrees to use a minimum of 1,500,000 kw.-hr. per annum to operate seventy-six motors in and about its mills. The steam required for the dry kilns, the twin engines which propel the carriage, the "kickers" and "niggers" or log turners on the log deck—those machines peculiar to the lumber industry for which electricity has as yet failed to take the place of steam—and steam for heating the office, filing room, and other inclosed buildings, is secured also from the Oregon Power Company. This steam is used in such quantities as to require an 8-in. pipe with boiler pressure of 150 lb. to supply it, and is purchased at a flat rate of $45 a month. This appears to be a very low rate until it is understood that no account is taken of the fuel used to generate this steam. In other words, the lumber company pays $45 a month for the use of the boilers of the power company and furnishes the fuel.

The average energy consumption of the lumber mill is about 8500 kw.-hr. a day, and approximates daily 40 per cent of the connected load, which was the load factor figured on when building the plant. In addition to this energy used by the Booth-Kelly Company, the central station generates for commercial purposes from 250,000 to 500,000 kw.-hr. per month. In the accounting at the end of the month the power company pays the lumber company from $700 to $1,200 in cash after satisfying its account for energy used.

Handling the Wood Refuse

The plant of the Oregon Power Company is situated a little over 100 ft. from the sawmill, where it is very convenient for making the exchange of fuel for power. The fuel, as delivered to the power company, is in the form of shavings, sawdust and hogged fuel. It is sufficient to supply more than the entire needs of the generating plant, the surplus good refuse stock being placed in a wood bin for the local market, and the balance consumed by a modern inclosed and isolated burner located about 300 ft. from the mill and across a canal formed by the tailrace from the log pond. The shavings are blown through a distributing system into cyclones or sawdust collectors situated on the roof of the fuel bins owned by the power company, while the sawdust and hogged fuel is dumped into conveyors owned by the power company and extending underneath the sawmill. The fuel bins hold a supply large enough for ten days' run, so that a temporary shutdown of the mill does not disturb the power company's operation.

In the transfer of the fuel, it is first taken from the

FIG. 1—TURBINE ROOM SHOWING THE THREE UNITS, AUXILIARIES AND ELEVATED FEED WATER HEATER

mill to the fuel storage house, and can there either be taken directly to the boilers with another system of conveyors, or stored temporarily and later taken into the boiler room with still another set of conveyors.

THE CENTRAL STATION

The station utilizing the refuse from this lumber mill is known as the Springfield plant of the Oregon Power Company of Eugene. In regard to the present scheme of operation, Attilla Norman, vice-president and general manager of the company says: "We have been very much pleased with the result of our fuel contract with the Booth-Kelly Company which, while not directly profitable to us, has enabled us through co-operation with the lumber company to furnish them with electrical energy at a price which it could afford to pay, and at the same time it has enabled the lumber company to dispose of the waste product to us at a price which is lower than other fuel costs in this territory. While local conditions may greatly vary in different localities, we feel that co-operation along this line between sawmills and power companies may be expected more largely in the future." This statement is of interest for the reason that if the power company were using coal at the present price in Eugene, the cost per kilowatt-hour at switchboard would be between two and three times the present cost with wood fuel.

The furnaces used are of the Dutch-oven type equipped with stationary grates of plain girder type. The wood is fed in from the top of the furnace and fired under natural draft. The fuel beds and grates are not shaken or disturbed in any way. No difficulties have been experienced in the use of this refuse wood fuel, which is estimated to have a heat value of about 8000 B.t.u. per pound.

The station is equipped with five boilers totaling 1850 hp., and generating units having a rating of 3000 kw. This equipment consists of three units, two being 500-kw. Parsons type, Allis-Chalmers horizontal turbines with jet type condensers, and the other being a 2000-kw. General Electric horizontal, three-stage, Curtis type unit with surface condenser.

The Booth-Kelly Lumber Company operates sawmills at Springfield, Wendling, Cobourg and Saginaw, Ore. About four years ago the Springfield mill was destroyed by fire, which originated from a hot bearing. The new mill built on the site of the old plant is completely fireproof and has a capacity of about 175,000 ft. board measure per ten-hour day. The energy consumption per unit of output approximates 60 kw.-hr. per 1000 ft. board measure of lumber.

ELECTRICAL EQUIPMENT IN LUMBER MILL

The complete electrical equipment in the lumber mill, comprising seventy-six motors aggregating 2290 hp., together with transformers, switchboard and meters, was furnished by the General Electric Company. The main 2200-volt power lines from the Oregon Power Company lead in to a main incoming panel of a small switchboard room. This panel is equipped with K-12 overload and low-voltage release oil switch, and an integrating watt-hour meter and curve-drawing voltmeter. The transformer equipment in this sawmill substation includes three 100-kw., 2200/440-volt, single-phase, oil-cooled transformers for power, and two 5-kw., 2200/110-220-volt and two 10-kw., 2200/110-220-volt, single-phase transformers for the 35-kw. connected lighting load. A motor-driven air compressor and a 75-kw. motor-generator set and rectifier for battery charging are also located in this substation room in addition to the switching apparatus. The planing mill substation has a bank of three 25-kw., 2200-440-volt, single-phase, oil-cooled transformers.

All motors above 35 hp. are wound for 2200 volts, and an individual circuit runs from the switchboard to each of these motors and is served through a feeder panel. All motors of 35 hp. and below are wound for 440 volts, for which, in the sawmill, two main 440-volt circuits are run to centers of distribution, at which point is installed a steel distributing cabinet panel. Then from each cabinet individual circuits are run to the various motors. All circuits to all motors are carried from their respective feeder panels or cabinet panel circuits in underground conduit, so that the only wiring which is seen in the mill is the short length leading from the base of the foundation up to the motor terminals, or to the starting compensator. This same scheme is employed in both the sawmill and planing mill.

MOTORS AND MOTOR CONTROL

All motors in the sawmill and planing mill are of the squirrel-cage induction type, with the exception of the

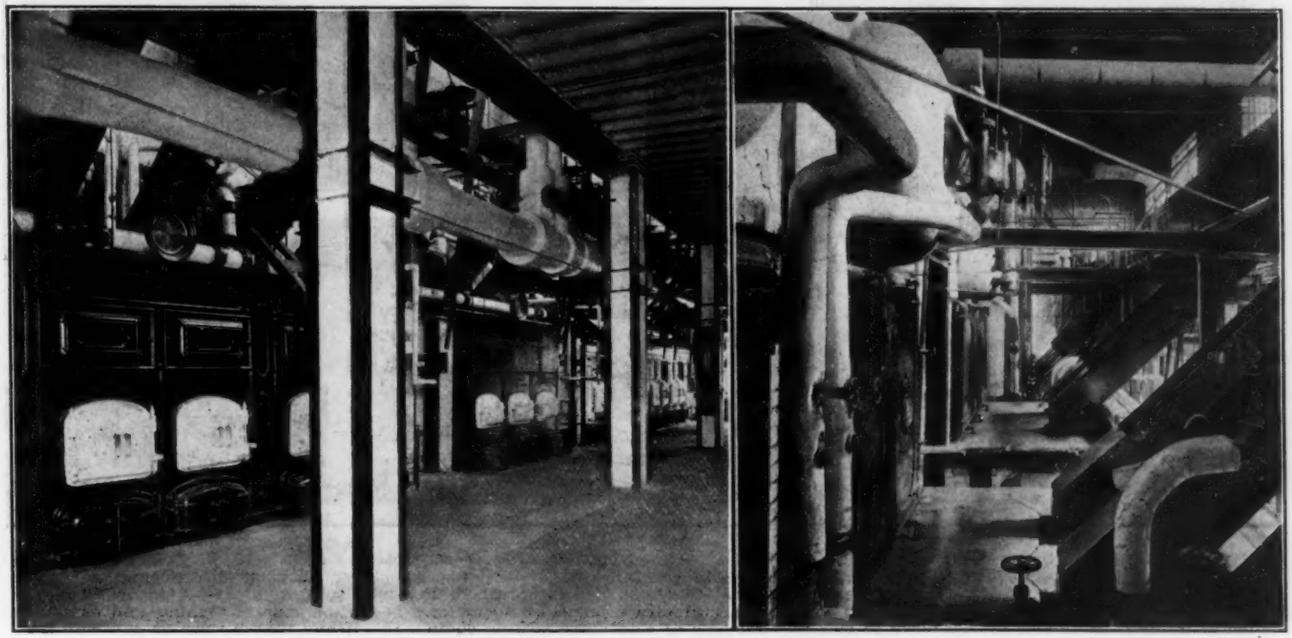


FIG. 2—BOILER ROOM OF OREGON POWER COMPANY'S STATION SHOWING DUTCH OVEN TYPE FURNACES AND FUEL SPOUTS OVER THEM

Alternating-Current Motor Drives in the Springfield (Ore.) Plant of the Booth-Kelly Lumber Company

1—Electric storage battery tractor hauling 4-ton load. 2—A 200-hp. motor direct connected to an edger. 3—Combination high-speed matcher and resaw in planing mill driven by direct-connected motor. 4—High-speed planer showing direct-connected motor and profile attachment belt driven from separate motor. 5—Motor generator set in saw-mill substation. 6—A loaded monorail hoist taking a curve. 7—Five-in. band saw in planing mill direct connected to motor. 8—Cut-off saw in planing mill connected to motor by belt. 9—Motor geared down to suit requirements of slow-speed sorting chain. 10—Heavy timber sizer on saw mill floor direct connected to motor. 11—Heavy duty sizer and matcher direct-connected to motor. 12—Horizontal resaw connected to motor by belt. 13—Motor mounted under mill floor driving transfers and chains.

TABLE I—MOTOR EQUIPMENT OF THE BOOTH-KELLY LUMBER COMPANY SPRINGFIELD, ORE.

Mill Machine	Driving Motor*	Character of Load
SAWMILL—*Three-Phase 2200-Volt Motors*		
12-in. x 72-in., 7-saw	One 200-hp. 1200-r.p.m. K	Very fluctuating load, high peaks.
Two 44-ft. trimmers	Two 150-hp. 720-r.p.m. K	Continuous load with intermittent irregular peaks.
Timber sizer, 16-in. x 30 in.	One 75-hp. 900-r.p.m. K	Intermittent load, relatively steady when running.
10-ft. single cutting band mill	One 300-hp. 600-r.p.m. M	Intermittent load, fluctuating—heavy starting duty.
Ready sizer	One 50-hp. 1200-r.p.m. K	Intermittent load, relatively steady when running.
Special double exhaust fan	One 75-hp. 900-r.p.m. K	Steady, continuous load.
Air compressor	One 50-hp. 900-r.p.m. K	Intermittent, steady load.
Motor-generator set	115-hp. direct connected to 75-kw. 250-volt d. c. generator	
48-in. hog	One 100-hp. 900 r.p.m. K	Fluctuating, continuous load
Three-Phase 440-Volt Motors		
Log lift	ITC 5013 52-hp. 600-r.p.m. M	Intermittent hoisting duty, heavy starting load.
Canting gear	One 15-hp. 900-r.p.m. K	Intermittent heavy duty, light starting load.
Rock saw	One 15-hp. 900-r.p.m. K	Light load start, intermittent running load, fluctuating.
Rock saw 30-in. single fan	One 15-hp. 1200-r.p.m.	Steady, continuous load.
Log carriage set works	KT 5-hp. 900-r.p.m. C	Continuous load with intermittent regular peaks.
Transmission, consisting of conveyors, live rolls, transfer chains, etc	Three 125-hp. 900-r.p.m. K Six 120-hp. 900-r.p.m. K Seven 115-hp. 900-r.p.m. K Four 110-hp. 900-r.p.m. K Two 17 ½-hp. 900-r.p.m. K One KT 5-hp. 900-r.p.m. C	Steady, continuous, light starting loads. Load thrown on through friction device.
6-ft. band resaw	One 100-hp. 720-r.p.m. M	Intermittent load fluctuating: heavy starting duty.
Band ripsaw and live rolls	One 20-hp. 900-r.p.m. K	Intermittent load fluctuating.
48-in. swing crosscut saw	One 10-hp. 900-r.p.m. K	Intermittent load with high peaks of very short duration.
60-in. swing crosscut saw	One 20-hp. 900-r.p.m. K	Intermittent load with high peaks of very short duration.
Grinders for sizer and ready sizer knives	Two ½-hp. 1800-r.p.m. K	Intermittent, steady load.
Stacker for dry kiln and transfer chains	One 10-hp. 900-r.p.m. K	Fluctuating intermittent load
Unstacker and sorting chains for dry stack	Two KT 5-hp. 900-r.p.m. K	Intermittent load, steady when running.
File room	Two KT 5-hp. 900-r.p.m. K	
Machine shop	KT 5-hp. 900-r.p.m. K	
Wood saws and conveyor	One 35-hp. 900-r.p.m. K	Fluctuating
250-Volt D. C. Motors		
Cant transfer to gang	One 4-hp. crane motor One 7½-hp. crane motor	Crane duty
PLANING MILL—*Three-Phase 2200-Volt Motors*		
Sizer, 10-in. x 30-in.	One 60-hp. 900-r.p.m. K	Intermittent load, relatively steady when running.
Matcher, 6-in. x 20-in.	One 50-hp. 900-r.p.m. K	Intermittent load, relatively steady when running.
Matcher and resaw: 6-ft. x 15-in. matcher 5-ft. x 4-in. resaw	One 150-hp. 900-r.p.m. K One 135-hp. 900-r.p.m. K 440-volt.	Intermittent load, relatively steady when running.
Special double exhaust	One 75-hp. 900-r.p.m. K	Steady, continuous load.
Three-Phase 440-Volt Motors		
Profile attachment for 6-ft. x 20-in. matcher	One 15-hp. 900-r.p.m. K	Intermittent load, steady when running.
Band ripsaw	One 20-hp. 900-r.p.m. K	Intermittent load, fluctuating.
Swing cut-off saws	One KT 5-hp. 900-r.p.m. C Two KT 2-hp. 1800-r.p.m. C	Intermittent load with high peaks of short duration.
Filing room	KT 5-hp. 900-r.p.m. C	
Sorting chains	Two 5-hp. 900-r.p.m. C, back-geared 7/1	Steady, continuous load.
Belt conveyors	2-hp. 900-r.p.m. C, back-geared 7/1	Steady, continuous load.
Conveyor chains	3-hp. 900-r.p.m. C, back-geared 7/1	Steady, continuous load.
Single-Phase 110-Volt Motors		
Portable grinder for matcher knives	½-hp. 1800-r.p.m.	Intermittent duty.
Monorail System		
Hoist and traveling car	One 11-hp. and one 18-hp. 250-volt d. c.	Crane duty.
Transfer crane	One 17-hp. and one 22-hp. 250-volt d. c.	Crane duty.

*Type letters refer to General Electric designs of motors.

ITC 50-hp. log hoist motor, the "I" 300-hp. "M" constant-speed headsaw motor, the "I" 100-hp. "M" constant-speed resaw motor, and the 4 and 7½-hp. d.c. series cant crane motors. All motors above 5 hp. rating are equipped with starting compensators with low-voltage release attachments and overload relays, and inclosing covers arranged for conduit wiring. The overload relays are of the inverse time-limit type, and are adjusted in each instance to meet the requirements of the particular motor controlled. For instance, a conveyor motor runs at relatively constant load, and therefore the relay is set at approximately 150 per cent load and with very little retardation, since any overload would practically mean that the conveyor was jammed, and the relay should clear the motor before too much of a strain is imposed upon the different parts of the transmission equipment.

In the case of the edger motor, however, which is a 200-hp., 1200-r.p.m. squirrel-cage design, very high peaks of relatively short duration are encountered. The average length of time which it takes a cant to pass through the edger is probably ten seconds, and with very low speed not more than twenty seconds. The load, however, during this period, may reach such a value that the motor input would be 450 to 500 kw. Hence the relay for this motor is set for 150 per cent load with long retardation, such that if 150 per cent load were sustained for five minutes the relay would disconnect the motor. If 200 per cent load were sustained, the motor would be disconnected in a shorter period, but in any event the motor would be capable of carrying a load almost up to the breakdown point of the motor for thirty seconds without being disconnected from the circuit.

For the log hoist motor the primary is controlled by an oil switch with overload and low-voltage release attachments. Its operation is controlled by a secondary drum-type reversing controller, which in this particular instance is known as a T-10-J design. The headsaw motor is likewise controlled by a secondary drum-type controller, and in the primary is inserted a 200-amp. K-5 overload and low-voltage oil switch. The resaw equipment has the same type of control as the headsaw motor. The cant crane motors are standard CO-2503 and CO-2504 motors equipped with R-122 drum-type reversing controllers. These controllers are mounted on the mill floor within easy reach of the gang-saw operator, so that he can control the hoisting, lowering and travel of this crane without leaving the operating position at his machine.

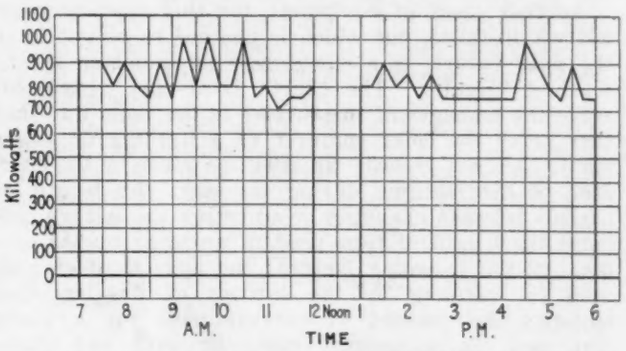


FIG. 3—TYPICAL MOTOR LOAD OF ELECTRICALLY OPERATED MACHINERY IN PLANT OF BOOTH-KELLY LUMBER MILL

The Oregon Power Company is operated by H. M. Byllesby & Company, Chicago, Ill. Attilla Norman is vice-president and manager at Eugene, Ore. A. C. Dixon is general manager of the Springfield plant of the Booth-Kelly Lumber Company at which the operating conditions outlined were worked out.

Analysis of Moving Picture Theater Lighting—II

Considerations in the Selection of a Projection Screen Including Distribution of Brightness, Elimination of Eyestrain and Screen Efficiency

By L. W. McOmber

Member Engineering Staff, Vaughn, Meyer & Sweet, Consulting Engineers, Milwaukee, Wis.

THE section of this article published in last week's issue of the ELECTRICAL WORLD took up the details of special interior and exterior lighting for the Merrill Theater in Milwaukee, Wis. In what follows here the problems involved in the selection of machine-room equipment and a suitable projection screen are outlined.

The Motion-Picture Machine Room

In this installation particular attention was paid to the picture projection engineering; that is, to the lay-out of the machine room installation, machine selection, proper projection screen, etc. The machine room, 18 ft. long by 8 ft. broad, is located back of the balcony and slightly above it. At one end is a workshop, at the other end a small ventilated fireproof chamber containing the grid resistances for the projection machine lanterns. On the back wall is a large steel distribution cabinet which controls all the power used in the machine room. Two three-wire, 220-volt, direct-current services are brought to the cabinet for the regular service and the emergency service. These machine services are connected to the bus by a three-pole, double-throw switch, so that it is possible to throw the entire load on either service.

The machine room contains two moving-picture projection machines and one dissolving stereopticon. Each moving-picture machine is connected to a two-pole, double-throw switch, so that it may be run on a motor-generator set, or in case of trouble may instantly be thrown over across the line with resistance in series.

At present the machines are being run the latter way, with grid resistance enough in series to cut down the current to the required amount. Provision has been made for the installation of the motor-generator set, and this will be done in the near future on account of the saving in running expense due to the higher efficiency of the motor-generator set as compared with the resistance-in-series method. Each stereopticon is connected through a two-pole, single-throw switch directly onto the bus, with a special resistance in series with the carbons.

Another piece of equipment for this machine room not yet installed, but which is planned to be put in in the near future, is a curve drawing ammeter on the machine circuits. The charts from this instrument serve the manager of the theater in the same way that they serve the chief engineer of a lighting or power plant. A chart records the attention given by the operator to his machine during the day; the length of periods between changing or adjusting the lantern carbons, the length of time used in warming up the carbons of the incoming lantern; the amount of current used in warming up the carbons of the incoming lantern; the amount of current used for a given film, and, in a general way, the care and attention that is being given by the operator to his work. With a graduated resistance or voltage control of a motor-generator set, the current through the lantern of a machine should be adjusted for each different film or section of film, the light required depending on the density and thickness of the film. When any particular film is shown for the first time in the presence of the manager, the brightness of picture desired can be determined and instructions given the operator as to the current to be used. From an inspection of the charts taken from the ammeter it is possible each day for the manager to check up the current used and to assure himself that a picture of proper brightness is being thrown on the screen whether he is present or not. It also furnishes a check on the expertness of the operator in taking care of the arc, timing the pictures, etc.

The Engineering in the Selection of Projection Screen

In the selection of the most suitable projection screen a large amount of research work was carried on, and a screen purchased according to the results of this research work. Samples of the various screens marketed by different screen manufacturers were examined and tested, and comparisons made between the various types. Special tests were run on a number of the screens which seemed to be satisfactory for the service required. In running these tests use was made of various photoplay houses, substituting for the arc light used in the lanterns a high-wattage nitrogen-filled lamp, with a voltmeter across the terminals of the same. All light was cut off from the screen except that which was allowed to pass through a small round orifice of only sufficient size to furnish a lighted area large enough for the use of a photometric instrument. Brightness readings were then taken with a Macbeth illuminometer from various angles, taking from three to five readings on the screen for each angle. These readings were then plotted, giving curves some of which are shown in Figs. 3, 4, 5 and 6.

As a result of the tests, all screens were eliminated except two—one, a matt surface, or diffusing screen, and the other a so-called 'focusing'-type screen, having a pure white surface covered with small glass beads or globules about the size of grains of sand. The first of these was a locally-prepared screen and the second was the best of the various focusing-type screens inspected. In Figs. 4 and 5 are given the distribution curves of brightness for these two screens. In order to see the practical value of these brightness curves, a cross-section of the theater has been drawn in on the same sheet, showing the proper angular relation between the screen and the auditorium. By considering the curve in connection with the auditorium outline, the apparent brightness of the screen as viewed from various parts of the auditorium can be quickly measured or compared.

Referring to Fig. 4, it is seen that with the matt surface or diffusing screen the brightness of the screen as viewed from any seat in the auditorium appears of practically constant value, though decreasing very slightly at the front seats of the house. It must be remembered also that the same form of curve would be shown if readings were taken at right angles to this curve; that is, in a horizontal plane through the beam of light and the curtain.

From Fig. 5, showing the focussing screen, it is seen that the brightness of this screen varies considerably when seen from various seats in the house. The maximum brightness appearing at the same angle as the incident ray and falling off materially at the seats to-

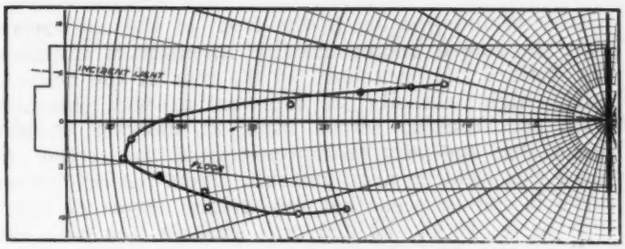


FIG. 3—BRIGHTNESS CURVE PLOTTED FOR AN ALUMINIZED FOCUSING SCREEN

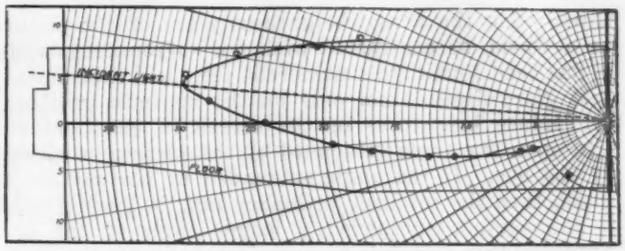


FIG. 5—BRIGHTNESS CURVE FOR CRYSTAL SURFACE OR FOCUSING SCREEN

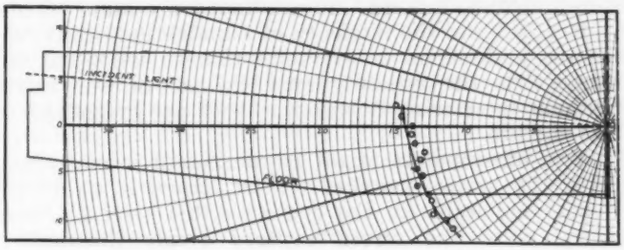


FIG. 4—BRIGHTNESS CURVE FOR MATT SURFACE OR DIFFUSING SCREEN

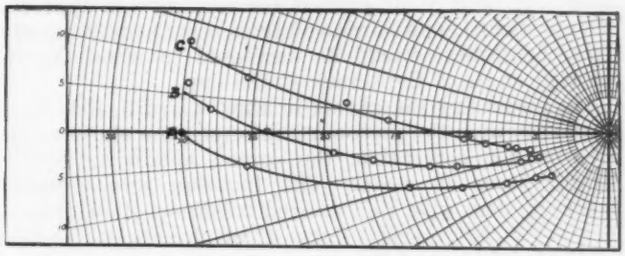


FIG. 6—VARIATION OF BRIGHTNESS WITH CHANGE IN ANGLE OF INCIDENT LIGHT

A is for incident ray at right angles. B for 5 deg. above horizontal. C for 12 deg. above horizontal.

ward the front of the theater. It is also interesting to note from Fig. 6, that with this screen when the incident ray of light is perpendicular to the surface, the brightness curve is much broader and less concentrating than when the light falls on the screen at an angle other than a right angle, and as this angle between the incident ray and a perpendicular to the screen increases, the curve becomes sharper, which means less suitable for projection purposes, as the curve will not "cover" the seating area properly.

In Fig. 3 is shown a curve fairly typical of the general class of focusing screens. It may be seen that this screen follows more or less the law of specular reflection, the angle of the incident light being approximately equal to the angle of the maximum reflected ray. The result is, that unless the incident ray is perpendicular to the screen the screen will appear brightest at seats about half way to the front, and seats further away will view a less bright picture, a condition not to be desired.

In making a decision as to the proper screen to install, the following various factors were considered: First, a distribution of brightness, such that a clear picture is seen from all parts of the house, with a minimum of light thrown on the side walls; second, the securing of the maximum of brightness with the least amount of eyestrain, and, third, a high efficiency of reflection, which means a lower cost of current for an equally bright picture.

DISTRIBUTION OF LIGHT REFLECTED FROM SCREEN

In considering the first factor it is self-evident that the picture viewed from any seat in the house must show a bright, sharp image as well as a certain so-called "depth" of picture, a characteristic of good photography and good projection, which takes the flatness away from a picture and makes objects in the foreground stand out and away from the background. To obtain these conditions it is necessary to have a strong projected light and the screen protected from other light rays, which cause a so-called "veiling glare"—a dimming of the picture. This veiling glare is produced by the house lights and by any reflected light from walls or ceiling. If a screen, such as is shown in Fig. 4, is used in a narrow house, it is seen that a large percentage of the reflected rays are thrown to the sides where there are no seats, and striking the walls are cause of more or less veiling glare unless the side walls are of dark

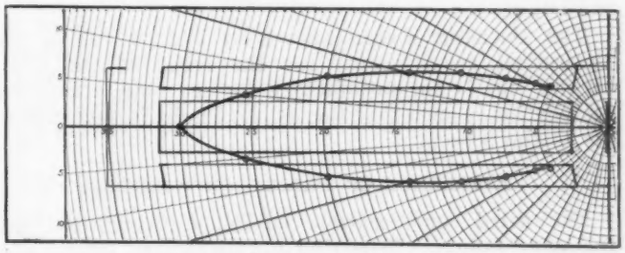


FIG. 7—CURVE OF SCREEN DISTRIBUTION ADAPTED TO BUILDING PLAN

enough color to absorb the light. If the focusing screen is used (Fig. 5), then the greater proportion of the light is thrown into the body of the house and but little light strikes the side walls, as can be seen from a study of the curve, which means a bright picture and little veiling glare. In a wide house it is evident that the focusing screen could not be used, as those seats at the side would view a very dull and flat picture, while with the matt-surface screen the picture would be as good at the sides as in the center of the house.

The various curves of distribution were tried out on a seating plan of the auditorium, Fig. 7, showing the focusing screen as drawn out. It is seen that fully 80 per cent of the seats are within the 20-deg. angle from the perpendicular to the screen, and all light rays of any great magnitude hit the side walls at such a large angle that the illumination on them is very low indeed. If the curve of Fig. 4 is considered as being tried out in a similar manner, it will be seen that while the audience will all see approximately an equally clear picture, at the same time a large amount of light will be thrown on the walls, causing a considerable veiling glare as stated above.

ELIMINATION OF EYESTRAIN

The second consideration, eyestrain, has a very important bearing on the selection of a screen, since the comfort of the audience and hence a factor of the popularity of the house depends on it. Eyestrain may be considered as being caused, first, by the flicker on the screen due to the projection machine; second, by the contrast glare, which depends to a great extent upon the densities of the various parts of the film itself, and,

third, upon the actual brightness glare of the picture as a whole, as contrasted with the surrounding walls. It has been found from numerous tests and experiments that glare depends not only on the intrinsic brilliancy or surface brightness of the screen in question, but also upon the angle subtended by the surface as viewed by the eye. If the angle subtended by the surface is small, then the intrinsic brilliancy may be greater than if the surface subtended a larger angle at the eye. Applying this principle to a projection screen, it is evident that the theoretically ideal condition would be to have a screen which when viewed from a distance would be at the limit of brightness for comfort (no appreciable eyestrain), and as viewed from seats nearer the surface, brightness would be decreased to offset the increased angle of the screen at the eye.

On inspecting the curves in Figs. 4 and 5, it is to be seen that with the matt-surface screen the above condition is not obtainable, the screen appearing equally bright from all seats. The focusing screen tested, however, does give this desired variation of brightness due to its characteristic form of brightness curve; that is, the brightness of the screen as viewed from the front seats is much less than when viewed from the rear seats. It is interesting to note that with this screen the brightest, best picture is seen from the rear seats in the balcony, seats which are usually the poorest in the house.

The focusing screen shown in Fig. 3 fulfills the theoretical requirements for the front of the auditorium, but is not satisfactory for the rear, unless the installation is such that the incident light is perpendicular to the screen.

Efficiency of Projection Screens

The third consideration, efficiency, brings out the following points. Requiring a satisfactory bright picture to be shown, it is evident that the brightness of any two different screens as they appear to the eye be the same. Referring to the curves again, Figs. 4 and 5, which are both taken with the same intensity of illumination incident on the screen, it is seen that for this particular theater the brightness of the screen to the audience is nearly twice as great with the focusing screen as with the matt-surface screen. In other words, the brightness curves can be considered as proportional to the efficiency of reflection at any particular angle. In considering the efficiency of the screen for this purpose, we are not so much interested in the true efficiency of reflection as a whole, as we are in the amount of light reflected to the eyes of the audience; in other words, there is only a narrow angle in which we desire a high reflective power, and outside of this angle, the poorer the reflection coefficient the better, as this light would be thrown on the walls, causing the "veiling glare" spoken of before. If in this particular installation the matt-surface screen were used, the illumination on the screen would have to be increased approximately 100 per cent in order to obtain the same brightness of picture in the rear of the house as is obtained with the focusing screen. It would even have to be increased above this amount to overcome the veiling glare which would result from all the side wall reflection.

As a result of the foregoing considerations and findings, the focusing screen, Fig. 5, was installed in the theater. It may be of interest to note that after the installation half of the screen was covered with a large section of the matt-surface screen and a picture thrown on this composite screen. The results obtained by inspection of a picture thrown on this screen corroborated the various conclusions mentioned above.

When the interior lighting of the auditorium was first considered, it was planned to give a very low intensity of illumination in the front of the auditorium near the screen, increasing this intensity of illumination toward the back until at the rear of the house a fairly high intensity of illumination was obtained. With the focusing screen installed, however, it was found that the very characteristics of the screen opposed this lighting arrangement. From the brightness curve it can be seen that any bright source of light, such as a brightly-lighted rear wall, in line with the audience, would have much more effect on the screen as a "veiling glare" than would light falling on the screen at an angle, as is the case with the light from the projection lantern. It was found necessary to considerably lower the intensity of illumination in the rear of the auditorium to overcome this objection; at the same time the intensity near the screen was raised without interfering in any way with the brightness of the picture.

Two other points might be mentioned in connection with the screen installed: First, there is no bright "spot" noticeable to the eye with this screen. From every point the screen appears evenly illuminated. Secondly, the screen may be cleaned with soap and water, and shows practically as high an efficiency after cleaning as when first installed.

The Merrill theater is owned by the Badger State Investment Company of Milwaukee and managed by H. D. Graham. Its commercial success in competition with theaters charging a much lower admission is an indication of possibilities of high-class productions presented under proper lighting conditions. The feature lighting in the entrance, where a color-changing apparatus is in use to give a shifting color in the indirect lighting of the outer lobby also has extensive commercial possibilities. This has been accomplished by using lamps of as nearly as possible the three primary colors, changed in regular cyclic order by dimmers operated from a motor-driven shaft. It was found that very good color synthesis could be obtained by using two 1000-watt units for the blue component, two for the red and a single one for the green, as explained in last week's issue. In this direct and simple way the outer lobby is flooded with changing color varying in hue, but not in intensity, the effect thus produced being both pleasing and attractive.

The illumination problems outlined were investigated and worked out by Vaughn, Meyer & Sweet, Milwaukee, Wis.

Improved Motor Drive for Textile Mill Service

In the plant of the Nashua (N. H.) Manufacturing Company, individual motor drives have been gradually installed until motors totaling 3000 hp. are in operation. A recent adaptation of the individual principle in this cotton mill is used in connection with a cop breaker which converts waste ends and threads into cotton for re-use in spinning thread. Formerly this machine was operated by a 30-hp. to 35-hp. motor since the machine required this amount of power for starting. One-sixth of this amount is, however, sufficient for driving the machine in actual operation.

By the new arrangement, which is the first application of this type of drive to this type of machine, six motors are installed, one belted to each shaft. Five of the motors are of 7.5 hp. and one of 15 hp. The individual motors are economical of energy since the action of the shafts is more or less reciprocal and there is less overload than with a single motor. In addition a large amount of shafting and belting from the ceiling is obviated. The scheme has been devised by Charles H. Austin, electrical engineer for the company.

Economics of Group System of Street Lighting

How a Rearrangement of Distribution Circuits and Transformer Equipment on a $3,750,000 Job Will Effect a Material and Labor Saving of $13.44 per Lamp

By MONTAGUE FERRY, Consulting Engineer
With Estimates by E. M. TOMPKINS, Electrical Engineer, City of Chicago

AN arrangement of circuits has been worked out by the writer which can be employed to serve series street lamps with less initial expense, less danger to lamp maintenance men, less chance of interruption to service, and with possibly less losses than attend the use of other series systems. It is a development of the series-multiple system, and consists briefly of a number of small series circuits, each served by a low potential transformer, the primaries of these group transformers being connected in series to a constant-voltage high-potential source of supply. For example, a system containing 220 20-volt series lamps would be split into ten isolated groups of twenty-two lamps, each served by a 400-volt transformer. The primaries of the ten transformers required would in turn be connected in series to a 5000-volt circuit.

FIG. 2—TYPICAL INDIVIDUAL TRANSFORMER LIGHTING CIRCUIT

There are two distinct advantages to this arrangement. First, the high potential is confined to the transformer primary circuit, so there is little possibility of dangerous voltages occurring at any lamp or post. Second, there is a great saving in the cost of cable, since only a relatively small portion requires high-potential insulation. There is also a considerable saving in transformer equipment, when compared with individual transformer installations, since the cost of group transformers is much less than that of individual transformers for the same number of lamps. In some installations, of course, individual transformers are not used, but even then the saving in cable more than offsets the cost of the group transformers. Another advantage is that the efficiency of group transformers is relatively high, about 96 per cent. Furthermore, the cost of transformer installation is less per lamp served with group units because fewer are required, and several that serve adjoining territories may be installed in one manhole convenient to all the circuits. In addition, the possibility of service interruption to the entire system is minimized because disturbances in one group are confined to that group, while occurrence of faults in the main artery, the high-voltage primary circuit, is lessened because of its relatively short length and protected position underground. The system has the demerit, however, that auxiliary devices are required to protect the transformers and line from lamp and circuit failures and to prevent the outage of all lamps in any group when faults occur therein.

TABLE I—COMPARATIVE ESTIMATES FOR COST OF 220-LAMP CIRCUIT

Group Transformer System		Cost per Lamp	Individual Transformer System		Cost per Lamp
Low-potential cable, 39,600 ft. at 14 cents	$5,530.00		None		
High-potential cable, 3,300 ft. at 22 cents	726.00		35,200 ft. at 22 cents	$7,730.00	
Lamp leads (none)			2,200 ft. at $0.024	52.80	
	$6,256.00	$28.50		$7,782.80	$35.40
220 film sockets	275.00		220 plain sockets	110 00	.50
Ten transformers, 2 kw	350.00	1.25			
Ten transformers, splices and protectors	100.00		220 transformers, 72 kw	1,430.00	6.50
Four manholes	300.00	3.40			
Total material	$7,281.00	$33.15		$9,322.80	$42.40
Fifty alley crossings at $22.40, twenty-five street crossings at $49.00	$2,340.00	$10.60		$2,340.00	$10.60
220 globes at 90 cents, 220 lamps at 77 cents	367.00	1.67		367.00	1.67
220 posts at $13.50, 220 foundations at $2.50	3,520.00	16.00		3,520.00	16.00
Trench refill at $0.045 per ft., cable laying at $0.023 per ft	2,640.00	12.00		2,640.00	12.00
Setting and painting posts	220.00	1.00		220.00	1.00
Connecting ten transformers	60.00	.27	Connecting 220 transformers	770.00	3.50
Teaming 2½ per cent material	182.00	.83		233.00	1.06
Total labor	$9,329.00	$42.30		$10,090.00	$45.83
Total material	7,281.00	33.15		9,322.80	42.40
	$13,610.00	$75.45		$19,412.80	$88.23
Overhead 5 per cent	680.50	3.76		970.65	4.42
	$14,290.50	$79.21		$20,383.45	$92.65

Saving per lamp, $13.44.

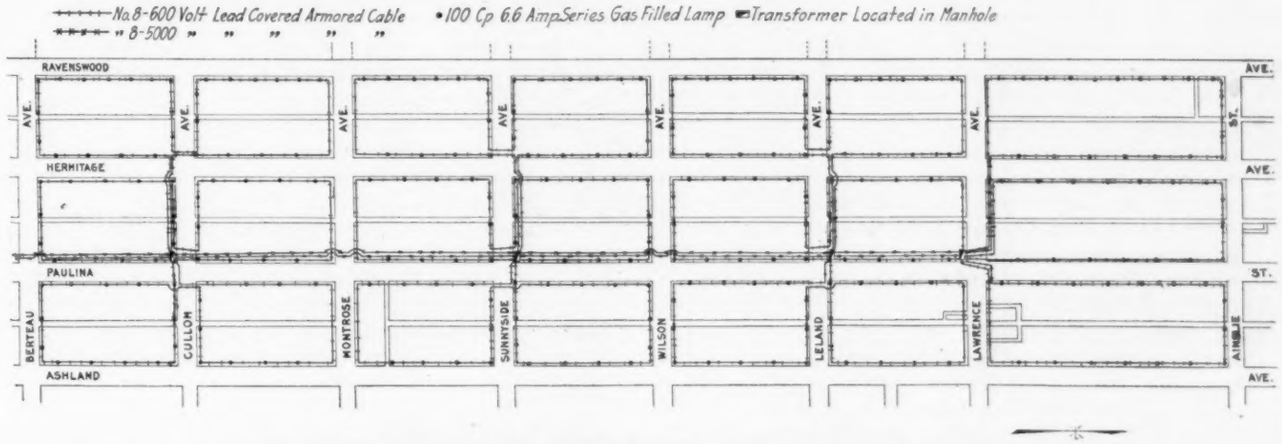


FIG. 1—ARRANGEMENT OF GROUP TRANSFORMER CIRCUITS IN A LONG, NARROW DISTRICT

TABLE II—COST OF GROUP-TRANSFORMER SYSTEM IN LONG DISTRICT

Material for 270 Lamps	
49,540 ft. No. 8 V. C. L. C. armored cable, at $0.12 per ft.	$5,944.80
Four manholes complete, at $83.60 each	334.40
Forty-seven alley crossings (16 ft.), at $22.40 each	1,052.80
Twenty-four street crossings (35 ft.), at $49.00 each	1,176.00
Three 1½-kw. transformers, at $30.00 each	90.00
Nine 2-kw. transformers, at $35.00 each	315.00
270 lamppost foundations, at $2.50 each	675.00
270 lampposts (225 lb.), at $13.50 each	3,645.00
270 film sockets, at $1.25 each	337.50
270 globes (14-in. ball), at $0.90 each	243.00
270 lamps (100 cp.), at $0.768 each	207.36
7700 ft. No. 8 V. C. L. C. armored 5000-volt cable, at $0.22 per ft.	1,634.00
Twenty-four Wilson separable splices, at $3.00 each	72.00
Twelve transformer protections, at $5.00 each	60.00
	$15,846.86
Labor	
48,798 ft. of trench and refill (less alleys), at $0.04½ per ft.	2,195.91
Placing cable (57,240 ft.), at $0.23 per ft.	1,316.52
Connecting cable (270 lamps), at $0.25 each	67.50
Setting lampposts (270), at $0.75 each	202.50
Painting posts (270), at $0.25 each	67.50
Teaming, 2½ per cent of material	396.17
Installing twelve transformer protections, at $6.00 each	72.00
	$20,164.96
Overhead expense 5 per cent	1,008.25
Total cost for 270 lamps	$21,173.21
Cost per lamp, $78.42.	

TABLE III—COST OF GROUP-TRANSFORMER SYSTEM IN SQUARE DISTRICT

Material for 321 Lamps	
62,760 ft. No. 8 V. C. L. C. armored cable, at $0.12 per ft.	$7,531.20
Four manholes, at $83.60 each	334.40
Seventy alley crossings (16 ft.), at $22.40 each	1,568.00
Twenty-eight street crossings (35 ft.), at $49.00 each	1,372.00
Seven 1-12-kw. transformers, at $30.00 each	210.00
Eight 2-kw. transformers, at $35.00 each	280.00
321 lamppost foundations, at $2.50 each	802.50
321 lampposts (225 lb.), at $13.50 each	4,333.50
321 film sockets, at $1.25 each	401.25
321 globes (14-in. ball), at $0.90 each	288.90
321 lamps (100 cp.), at $0.768 each	246.53
3900 ft. No. 8 V. C. L. C. armored 5000-volt cable at, $0.22 per ft.	858.00
Thirty Wilson selarable splices, at $3.00 each	90.00
Fifteen transformer protections, at $5.00 each	75.00
	$18,391.28
Labor	
44,350 ft. of trench and refill, at $0.04½ per ft.	$1,195.75
Placing 66,660 ft. cable, at $0.023 per ft.	1,533.18
Connecting cable to 321 lamps, at $0.25 each	80.25
Setting 321 posts, at $0.75 each	240.75
Painting 321 posts, at $0.25 each	80.25
Teaming, 2½ per cent of material	459.78
Insulating fifteen transformer protections, at $6.00 each	90.00
	$22,871.24
5 per cent overhead	1,143.56
Total cost for 321 lamps	$24,014.80
Cost per lamp, $74.81	
Average cost for 591 lamps, $76.46	

The individual transformer system, which the group system is designed to improve on, has many of the advantages of the group system, but lacks the chief merit—that of smaller cost. It has the exclusive advantage, however, that failure of lamps does not affect the remaining serviceable ones. Furthermore, no auxiliary devices are required to provide this characteristic. The individual transformer system has several demerits, among which are increased liability of complete service interruption due to the relatively long main artery, or primary circuit, the difficulty of locating faults and an efficiency of only 90 per cent for the small transformers used.

Costs of Group and Individual Transformer Layouts

The relative costs of group and individual transformer arrangements are clearly brought out in the accompanying itemized estimates which apply to conditions in Chicago where a bond issue for rearrangement of circuits has been recently issued. Table I shows the comparative costs of installing group and individual transformer systems under the same condition, while Tables II, III and IV show the costs of providing group and individual transformer arrangements in different shaped sections. For instance, Table II is for a long, narrow district and Table III is for a square district. The circuit arrangements to which the estimates refer are indicated in Figs. 1, 2 and 3, which are actual sections in Chicago.

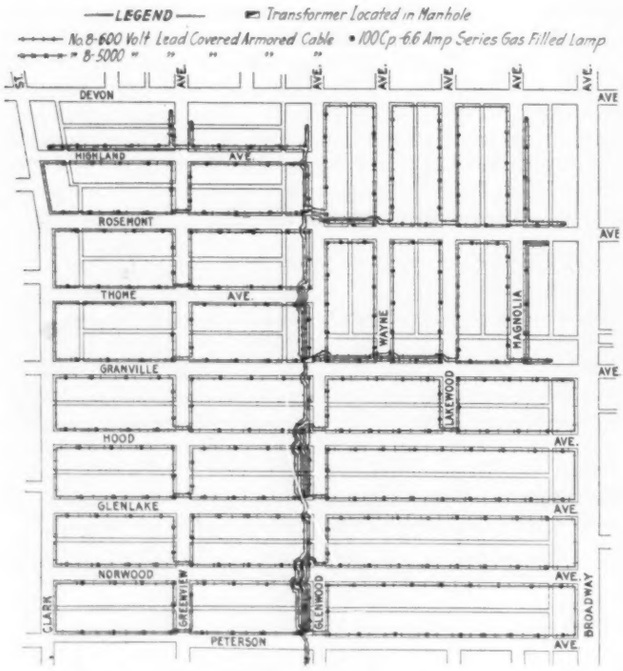


FIG. 3—GROUP CIRCUIT ARRANGEMENTS IN A SQUARE DISTRICT

Both estimates in Table I are based on the lamps being arranged the same and 150 ft. apart. The actual amount of cable required was measured from layouts drawn to scale. A greater length of cable had to be used with the group system than with the individual transformer system because extra cable is required to bring the terminals of each series group to the manholes where the transformers are located. Furthermore, the low-tension cable runs up each lamppost and connects directly with the lamp, whereas in the individual transformer system lamp leads run from each transformer at the base of the post to the corresponding lamps. As indicated, the total cable cost is only $28.50 per lamp for the group system, as compared with $35.40 per lamp for the individual unit system. It may be noted further that the transformer equipment used in the group system, including transformers, splices, protective equipment and cost of manholes, is $3.40 per lamp, compared with $6.50 for the individual unit system. There is a corresponding saving in the labor cost in favor of the group system, the cost of installing the ten group transformers being only 27 cents per lamp, as compared with $3.50 per lamp for connecting 220 small transformers on the unit system.

TABLE IV—COST OF INDIVIDUAL TRANSFORMER SYSTEM

Material for 230 Lamps	
36,426 ft. No. 8 V. C. L. C. armored 5000-volt cable, at $0.22 per ft.	$8,013.72
2,300 ft. No. 8 R. C. D. B. 600-volt cable, at $0.024 per ft.	55.20
Twenty-two street crossings, at $49.00 each	1,078.00
Thirty-five alley crossings, at $22.40 each	784.00
230 72-watt transformers, at $6.50 each	1,495.00
230 post foundations, at $2.50 each	575.00
230 lampposts (225 lb.), at $13.50 each	3,105.00
230 sockets (No. 156722), at $0.50 each	115.00
230 globes (14-in. ball), at $0.90 each	207.00
230 lamps (100 cp.), at $0.768 each	176.64
	$15,604.56
Labor	
32,816 ft. of trench and refill, at $0.04½ per ft.	$1,476.72
Placing 36,426 ft. of cable, at $0.023 per ft.	837.80
Connecting 230 transformers and lamps, at $3.50 each	805.00
Setting 230 posts, at $0.75 each	172.50
Painting 230 posts, at $0.25 each	57.50
Teaming, 2½ per cent of material	390.11
	$19,344.19
5 per cent overhead	967.21
Total cost for 230 lamps	$20,311.40
Cost per lamp, $88.31	

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

CASTING STATION BUSBAR COMPARTMENTS IN PLACE

Methods of Mixing the Concrete, Forming the Shelves and Bus Compartment Walls and Finishing the Concrete Surfaces

Illustrated herewith are steps in the process of casting busbar compartments in place—a method employed by the Havana (Cuba) Electric Railway, Light & Power Company in constructing its new generating station, described on page 1402 of the June 17 issue of the ELECTRICAL WORLD. The general features of this method, including the design of the concrete forms, methods of using them, and a suitable concrete mixture, were outlined in considerable detail in the same issue. In what follows are described the methods of mixing the concrete, forming the shelves and finishing the cell walls.

The mixing plant was set up in the basement under the galleries and at the end opposite that on which the work was started. Crushed stone was delivered through a basement window to a storage bin from whence it was drawn off through a wooden gate into a small measuring bin which held the proper amount for a charge. Sand and cement were handled in a somewhat similar manner. The mixed cement was drawn off into a bin where it could be released as needed, by means of a wooden gate. It was conveyed to the galleries in wheelbarrows by means of a donkey-engine hoist. An inclined runway permitted dumping the concrete from the wheelbarrows directly into the forms.

The shelves were made as follows: The expanded metal, after being cut to the proper shape, was secured to the main wall by means of the wire or strips of metal cast in place for that purpose. It was then backed on one side by a surface of boards while the cement mortar was applied to the opposite side with a trowel. Where possible the mortar was thrown from the trowel against the surface to secure greater cohesion. When sufficiently set it was surfaced by drawing over it a straight strip of wood guided by other strips which were secured to the edge of the shelf or barrier. The wooden backing was removed when the concrete had dried sufficiently to become self-supporting and the other side was then built up to the desired thickness. Expanded metal used for this work should be stiff both along its length and width but should contain as little metal as possible. Furthermore it should contain sufficiently large openings to permit a good bond with the cement and should be not much more nor less than 0.5-in. thick over all. The material known commercially as No. 4 "Rib Lath" was found to be well suited to this purpose.

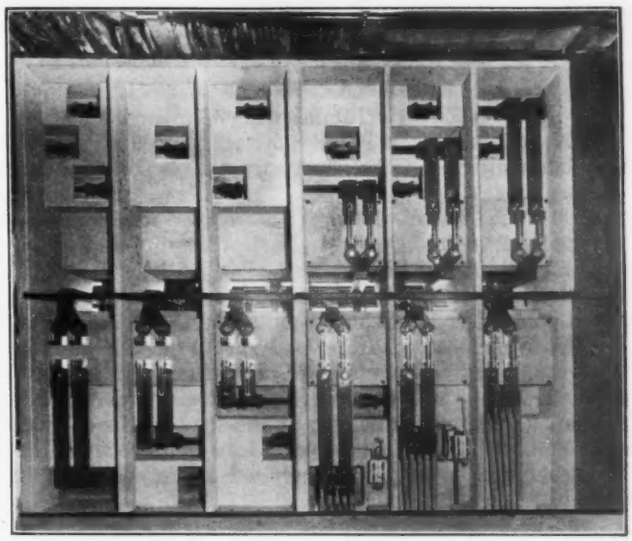
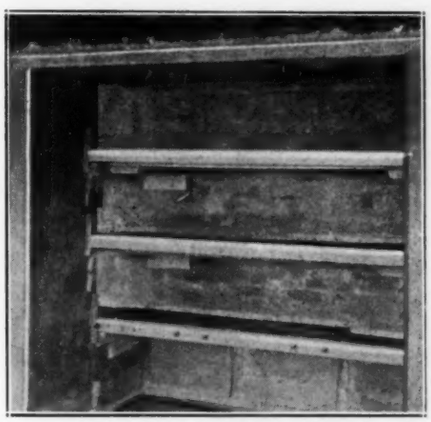
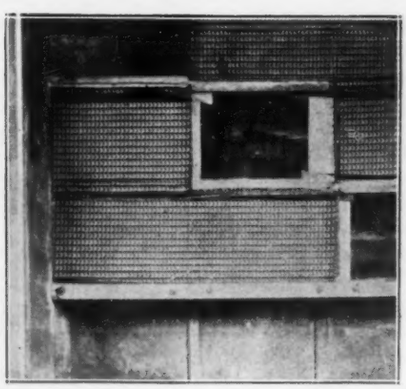
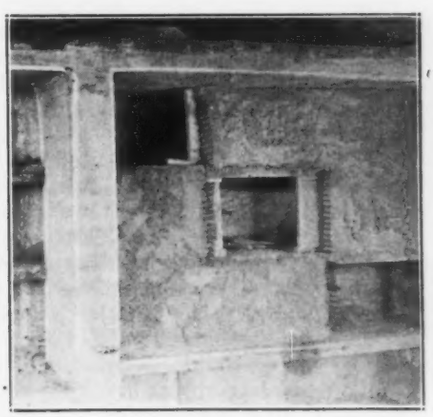


FIG. 4—SECTION OF A BUS COMPARTMENT CAST IN PLACE

As soon as the forms were removed the main walls were given a surfacing coat averaging 0.25-in. thick, the mixture being one part sand and one part cement. Only very finely screened, clean sand was used for this purpose. The built-up shelves and barriers were surfaced with the same mixture used for the body. To







FIGS. 1, 2 AND 3—STEPS IN CASTING BUS COMPARTMENT SHELVES AND WALLS

The shelves are made by placing reinforcing sheets on removable wooden shelves and covering same with concrete, which is subsequently surfaced by drawing a wooden straight-edge over it. The wooden strip also serves as a template for locating the disconnecting switch bolts. After the concrete is set the wooden shelves are removed. Fig. 2 shows the wall-reinforcing material in place with a wooden backing ready for the concrete to be applied. Fig. 3 shows the wall concrete in place with the reinforcing at the openings bent outward for tying to the vertical barriers to be cast later.

minimize the starting and spreading of cracks all corners were carefully rounded. After the structures were completely dry they were given one coat of light grey water-mixed paint. This was found to improve the appearance of the cells considerably since the natural concrete presented a mottled surface in so large a structure.

The methods described were developed by C. H. Sanderson, electrical engineer Havana (Cuba) Electric Railway, Light & Power Company.

Safety Measures for Cable Splicers

BY R. A. PAINE, JR.

The Edison Electric Illuminating Company of Brooklyn, N. Y., has, as a result of its experience, adopted the following rules to be observed by cable splicers when cutting cables:

6600-*Volt Cables.*—Before making the first cut on a three-phase, 6600-volt cable, a test shall be made to determine if it is "dead." This shall be done by removing the lead sleeve between the wipes and driving a metal-pointed rod into one conductor, the metal of the rod being connected to the lead sheath of the cable by a wire jumper and clamp. If more than one cut is to be made on a cable and there are apparent irregularities in the duct construction, or the tags on the cable do not check with the duct book, a test shall be made before each cut in the same manner as before the first one.

2400-*Volt Cables.*—Before cutting a single-conductor, 2400-volt, alternating-current cable, a test shall be made to determine if it is "dead" by removing a 6-in. ring of lead, cutting away the insulation, and testing with a bank of lamps.

No employee is permitted to cut or splice a four-conductor, two-phase cable while it is "alive." When a cable of this kind is to be cut, it shall be sawed in two without removing any sheath.

Series Lighting Circuits.—No series lighting-circuit cable shall be cut or opened until the overhead portion is connected to a ground on the cable-terminal pole. Before cutting such a series lighting-circuit cable during the hours in which current is supposed to be "on," the cable shall be removed from the rack and at least a foot away from any other cables; 6 in. of lead shall then be removed and a test made with a compass to determine if any current is flowing in the cable.

An additional warning is given as follows: Workmen shall wear rubber gloves throughout the process of testing and making the first cut in any three-phase, 6600-volt, two-phase, 2400-volt, or series arc-circuit cable.

Direct-Current Cables.—Before cutting any low-tension, direct-current feeder or sub-feeder, a test shall be made to determine if it is "dead" by removing a 3-in. ring of lead, cutting away the insulation and testing with lamps.

The metal-pointed rod used in testing three-phase cables has a wood handle 2 in. in diameter and 7 ft. long, so that it can be driven into a cable in a manhole from the street surface. The lamp bank used on 2400-volt, single-conductor cables consists of ten 230-volt 16-cp. carbon lamps connected in series in a wooden box 19 in. by 19 in. The lamp sockets are fastened to a wooden baseboard insulated from the bottom of the box by rubber buttons. One lead is brought out at each end of the box through a fiber tube, to which it is fastened with rubber tape. A leather handle is provided on the box for convenience in carrying. The lamp bank must be thoroughly inspected and tested with a magneto each time before using to see that none of the sockets or wiring is short-circuited.

Outdoor Substations for Irrigation Pumping Service

Low cost, reduction of fire hazard and elimination of dangerous operating conditions are noteworthy features of two outdoor substations recently designed and constructed by the Pacific Power & Light Company at transforming points on its system in central Washington.

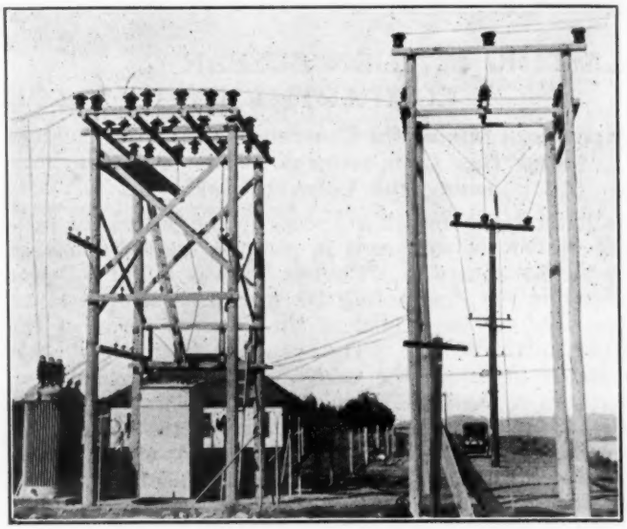


FIG. 1—COYOTE RAPIDS SUBSTATION, SHOWING METAL INSTRUMENT HOUSE AND SWITCHING STRUCTURE

This company has already put a number of its generating station transformers out of doors, and at one power house the transformers and lightning arresters are out of doors, within reach of a stiff-legged derrick that can also lift off a section of the roof of the small power house and pick up the generator and water wheel within when repairs are necessary.

The new outdoor substations are at Moxee and Coyote Rapids, near North Yakima. The energy at these points is stepped down from 66,000 volts to 6600 volts for irrigation distribution circuits. The Moxee substation was completed first, and includes a 500-kva. standard outdoor type transformer with current controlling and measuring equipment. The switchboard and instruments are inclosed in a small steel switchhouse, 9 ft. 6 in. high and about 4 ft. square. The frame is built of 2-in. by 2-in. by 0.25-in. steel angles, reinforced by plates at the corners. The walls are of No. 16 B.W.G. galvanized sheet steel, and the roof and floor are of 3/16-in. steel plate. The house has two doors in front to allow easy access to the switches, and double doors in the rear opening on the back of the board and on the instruments.

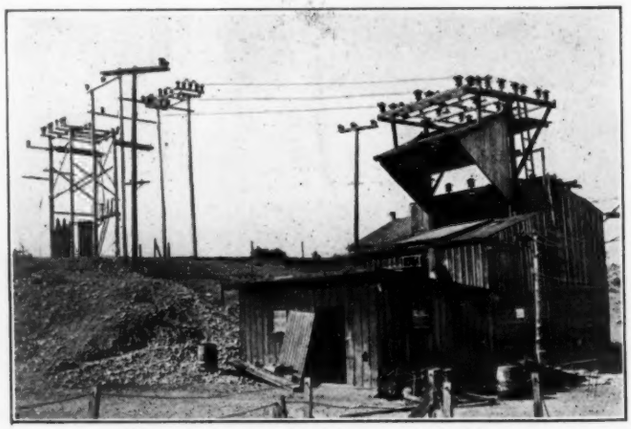
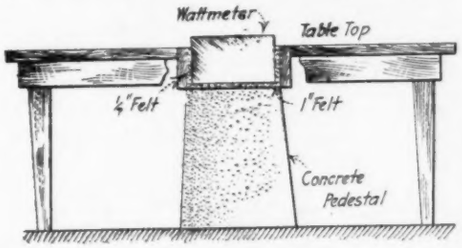


FIG. 2—WOOD STRUCTURE REPLACED BY COYOTE RAPIDS SUBSTATION SHOWN AT LEFT

The Coyote Rapids substation, which is shown in an accompanying illustration is similar in every respect to the one at Moxee except that the size of the transformer is 300 kva. The old substations that have been replaced were of temporary wood construction built about five years ago to take care of irrigation pumping loads. They were highly inflammable and took high rates of insurance, so that the new structures possess an advantage from this standpoint.

Foundation that Minimizes Vibration of Standard Wattmeter

To protect the standard wattmeter used in the laboratory of the Columbus (Ga.) Power Company from excessive vibration, D. H. Howell, foreman of the meter department, has mounted the instrument on a concrete pedestal, as indicated in the accompanying drawing.



CONCRETE PEDESTAL FOR LABORATORY STANDARD WATTMETER

The pedestal was built up under the table on which comparisons are made, a hole slightly larger than the meter having been cut in the table to receive the meter. Between the meter and the pedestal was placed a 1-in. piece of felt while around the sides of the instrument were inserted 0.5-in. strips. When the meter is not in service it is covered.

Recording the Performance of Large Boiler Units

BY GILBERT RUTHERFORD

In most generating stations will be found a complete installation of indicating, recording and integrating instruments for metering the electrical output of the station, but few instruments for measuring the input in the boiler room. This is due largely to lack of appreciation of the value of such instruments, which in turn has acted as a damper on the development of instruments suitable for boiler room use and has retarded instead of stimulated their development. Measuring instruments in the boiler room are always desirable, especially in the large stations operating units of high individual rating, where they improve economy of operation by making it possible for firemen to better handle the apparatus.

Within the last year or two several companies have secured interesting results from the use of instruments in their boiler rooms. Among these are the Commonwealth and Detroit Edison companies, who have installed complete instrument boards for use in connection with boilers which have a rating of 1225 and 2365 hp. respectively.

To supply steam to 25,000 and 20,000-kw. turbo-generators, the Commonwealth Edison Company operates boilers of 1225 hp. rating apiece, with economizers each having 8400 sq. ft. of surface. These boilers are capable of generating 80,000 lb. of steam per hour. Four boilers are made to constitute a bank or unit capable of operating the turbo-generator. These are large boilers, and as such have made it possible to follow a very admirable practice where otherwise it might be less advantageous to do so.

Each of these boilers is equipped with an instrument board, which is hung upon the boiler facing at a convenient height above the fireman's line of vision, and where he may see it with the least effort. These boards are well lighted, and in such a way that the light is cast upon the instruments instead of into the eyes of the firemen, thus avoiding the creation of a glare, as is so often found the case. Each instrument board holds two flow meters, one of which is in each steam lead, equipped with indicating, recording and integrating attachments; three recording gages for registering the temperature in the uptake, of the feed-water leaving the economizer and entering the boiler, and of the flue gases leaving the economizer; a CO_2 recorder, and two indicating draft gages, one in the furnace and the other in the intake to the stack.

The steam-flow meter enables the amount of steam being delivered or already delivered to be instantly obtained giving an indication of the present and past performance of the boiler. By watching the recording thermometers the temperature conditions of the economizer is available at all times, enabling faults to be investigated immediately or the proper precautions taken. The CO_2 recorder indicates, of course, the operation of the furnace, while the draft gages enable one to watch the condition of the boiler and economizer, detecting immediately when the resistance of the air passages is other than it should be, and by making available the pressure drop through the boiler and economizer affords a valuable indication as to whether or not soot or other obstructions exist.

As four boilers constitute a bank or unit, an instrument board is furnished for each bank. This board is placed facing down the aisle so as to be visible to the men as they watch their stokers and fires. This board contains eight meters—two flow meters, one measuring the steam input to the turbine, the other the feed-water to the boiler; two thermometers, one showing the temperature of the steam entering the turbine, and one that of the feed-water entering the economizer; two pressure gages for recording the pressure on the steam header and on the boiler feed header; an indicating wattmeter, and a clock. By means of these instruments the engineer in charge of a unit knows exactly the work that his boilers are doing, and he is able to watch and control the operation of each individual boiler and make it carry its pro rata portion of the load. By means of the wattmeter he is kept informed as to the load on the generator, and is thus better able to act on orders from the operator having control of the generator. By means of the clock peak-load periods may be watched, and by comparison with the loads on the generator conclusions may be drawn as to whether to push all the boilers or only one or two; the clock also assists the keeping of the logs on time.

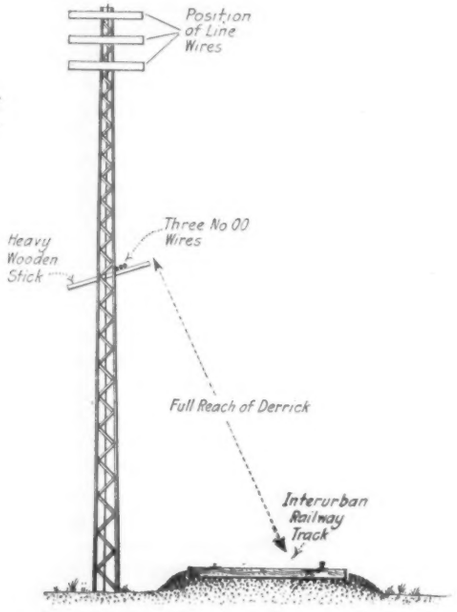
This is a very complete installation of instruments, and by their means the engineer in charge is able to do his part with precision and with little exertion to himself or his men. It is understood that automatic devices for measuring the coal fed to the furnaces will soon be installed. When this is done a complete and continuous record of operation and economy of these units will be available.

The use of meters in this way enables the operation of the boilers to be checked up at any and all times, and comparison made from day to day, thereby bringing to light faults in the boiler, economizer flues, boiler settings, etc. The use of instruments at the time of boiler tests plays an important part in securing the high efficiencies that are obtained during, and only

during, such times. It is probably not possible to maintain these high efficiencies because leaks above and below the grate, scale formation in the boilers, and clogging of boiler and economized tubes with soot will occur, but these conditions are immediately made evident by the meters; in fact, this is the reason for their installation.

Saving Linemen Heavy Lifts and Keeping Highway Crossings Open When Building Lines

On one occasion when a line crew was stringing wire for a second circuit on a transmission line that parallels an interurban railway in the Middle West, the wire derrick on the construction car was not high enough to reach the lowest cross-arm. Consequently the foreman could not follow the usual practice of using the crane to lift the wires. To save his linemen a part of the hard climbing and heavy lifting that they would have endured in carrying the lines up the full length of the



METHOD OF SUPPORTING CONDUCTORS ON TALL TOWERS WHILE STRINGING WIRES OVER HIGHWAY CROSSINGS

three-legged steel poles, the foreman devised the scheme of placing all three wires of the circuit on improvised pole brackets as shown in the accompanying drawing. These consisted of broom handles and other stout sticks laid between the latticed members of the 35-ft. poles. This scheme also proved helpful in keeping highway crossings open for vehicle traffic while the crew was at work at such crossings.

Method of Laying Submarine Cable Across Ohio River

Laying of submarine cables in deep sea water is an easy task compared with burying them in a trench cut in the rocky bed of a river according to William A. Keating of the Duquesne Light Company, which company recently employed this construction in laying two 11,000-volt cables across the Ohio River from Brunots Island to McKees Rocks. Hard limestone was encountered in the river bed at a depth of 8 ft. to 30 ft. throughout nearly the entire length of the cable run. Into this rock 20-ft. holes were drilled and loaded with

FIG. 1—EMPTY CABLE REEL USED AS PULLEY WHEN HAULING CABLE UP BANK AT BRUNOTS ISLAND

100 lb. of dynamite. Only three such holes were required, as each shot broke up the rock for a considerable distance around it. Although the trench thus made was somewhat irregular it served its purpose and besides was less expensive to construct than if several smaller and more closely-spaced shots had been fired. Each cable which was laid was 810 ft. long and consisted of three No. 4/0 conductors insulated with 8/32-in. rubber and 6/32-in. rubber belt over all. Mechanical protection was provided by a 9/64-in. lead sheath and an armor of No. 6 B.W.G. steel wires.

After the trench was made it took only one day to lay cables in it. To facilitate landing the island ends of each cable (which were on the inside of the reels) the cables were "paid off" the bow of a flat boat passed under the bottom and up the bank. When the flat boat reached the opposite side the cables were looped over an empty reel which was pulled up the bank by a block and tackle. This arrangement permitted landing the cables without taking the reels ashore. Frequent rises of the river made work difficult and at times stopped it altogether, the current being too swift to permit operating the boats with safety. On account of these difficulties it required a month to complete the work. A diver was employed throughout the job to ascertain the results of dynamite shots and to inspect the cable installation throughout its length in the trench after it was laid and ready for service.

FIG. 2—PAYING CABLE OFF THE BOW OF A FLAT BOAT AND UNDER IT

COMMERCIAL AND BUSINESS POLICY

A Department of Plans and Methods for Widening the Application of Electricity and for Extending Electric Service

Salesmanship the Missing Link Needed for Successful Municipal Operation

"Government and business touch elbows at many points along the march of human progress. Neither can exist without the other. Both are essential to the welfare of the people. They may be compared with the white and red corpuscles of the blood. They travel side by side along the same channels, in close company with one another. Government protects business. Business supports government. Each has its special function."

In these words E. Burt Fenton of W. S. Barstow & Company, New York City, outlined his conception of the proper functions and relation of business and government in his paper on municipal ownership topics read before the Ohio Electric Light Association this week.

"But," said Mr. Fenton, "neither can do the work of the other.

"When government engages in business, or business undertakes to govern, the whole machinery of both gets out of gear, and everybody suffers.

"Anything that involves the distribution of a product by the process of selling is a matter of business. Whatever the product, people must be persuaded to buy. It cannot be forced upon them.

"Government has no equipment for persuasion, for pleading, for coaxing, for argument. Its operations are founded entirely upon compulsion. When government buys—as it does many kinds of service and commodities—it does so merely from motives of policy. It could take the same things without compensation, if it chose—even in violation of its own laws—and there is no redress. Government cannot be prosecuted. Nor can it be civilly sued, except with its own consent and under regulations of its own making.

"Government has no peg on which to hang a selling organization.

"This is the 'missing link,' which suggested my title—the absence of, and the impossibility of developing, a governmental selling organization, one of the three elements upon which business must depend for its very existence."

A Jobber's Employees' Club That Educates and Promotes Better Service

The Q. Q. M. Club of the Frank H. Stewart Electric Company, Philadelphia, promotes the individual talent of its employees. Frank H. Stewart, president of the company, explains that the motto of the club is "Quality Plus Quantity Plus Mode of Conduct Equals Service." Membership is not compulsory and is open to all employees. The club's officers are selected principally from the sales department.

The meetings, which are held monthly, are conducted somewhat on the lines of a debating society, under parliamentary rules. Questions of interest to the company's trade and to the members are thoroughly discussed by everyone caring to participate—from the errand boys to the heads of the concern.

The club promotes acquaintanceship among the various employees who might not come in direct contact with one another in any other way.

SELLING SERVICE TO MINES

Increasing the Use of Electric Drive by Central Station Power in the Appalachian Coal Fields

BY WIGHTMAN D. ROBERTS

One of the newest and potentially greatest zones of industrial activity in the United States is that composed of the coal-bearing counties of West Virginia, southwest Virginia and eastern Kentucky, and in these counties the use of electricity from central stations in coal mining is increasing at a rapid rate.

At present more than 1500 coal mines are being worked in the states named. The approximate annual production of coal in the region is as follows:

West Virginia	70,000,000 tons
Virginia	8,000,000 tons
Kentucky	14,000,000 tons*

The available coal resources of these states—that is, coal unmined—are estimated by the United States Geological Survey and the different state mining departments as follows:

West Virginia	150,000,000,000 tons
Virginia	25,000,000,000 tons
Kentucky	45,000,000,000 tons

POWER SYSTEMS SUPPLYING COAL MINES

In the northern mining counties of West Virginia the Consolidation Coal Company has a central station which supplies electricity to some thirty of its plants. The Davis Coal & Coke Company also operates its twenty-four mines electrically from its own station.

In the central or Kanawha-New River mining districts of West Virginia, the Virginian Power Company supplies power to about seventy-five mining companies, each operating from one to eighteen mines, from its central station at Cabin Creek Junction on the Kanawha River. This steam plant contains at present two units of 10,000 kw. each, but with provision made for two additional units of 20,000 kw. The company at present is operating about 300 miles of transmission line, of

*Does not include Western Kentucky fields.

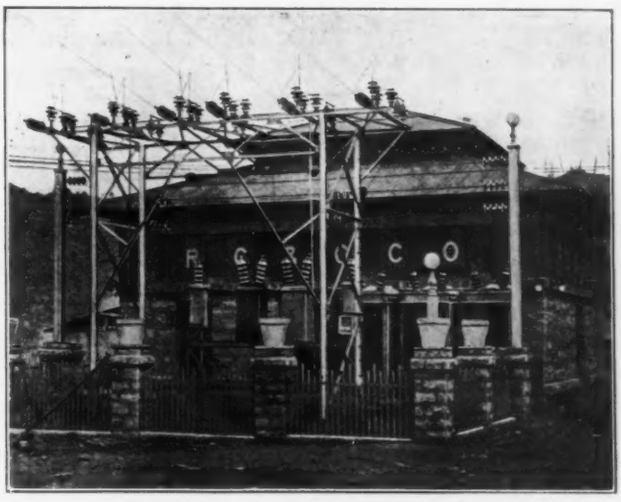


FIG. 1—SUBSTATION OF RALEIGH COAL & COKE COMPANY, SUPPLIED FROM SYSTEM OF THE VIRGINIAN POWER COMPANY

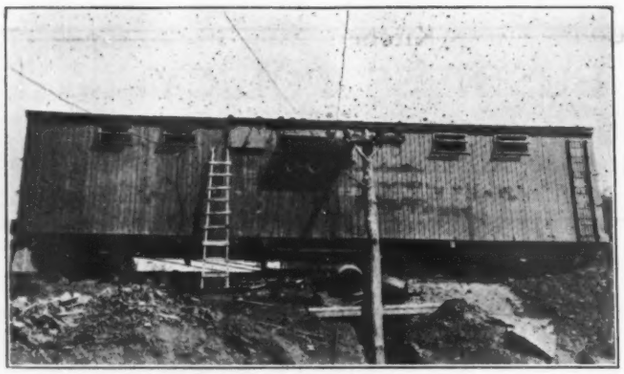


FIG. 2—PORTABLE SUBSTATION USED BY APPALACHIAN POWER COMPANY IN COAL-MINE SERVICE

which at least 200 miles, at 44,000 volts, is in mine service.

In the southern counties of West Virginia there are three central station systems: The Appalachian Power Company, with headquarters at Bluefield; the Logan County Light & Power Company, at Logan in the Guyan Valley coal field, and the Tug River Power Company, whose plant is at Sprigg, in the Thacker coal field.

The Appalachian Power Company has water-power developments on New River in the southern part of Virginia, where there now is installed 29,000 hp., with future developments for 60,000 hp. additional. It also maintains reserve steam plants at Roanoke, Va., Bluefield, Switchback and Welch, W. Va., with a combined capacity of over 10,000 kw. Power from these is transmitted to the coal fields of West Virginia and in some of the Virginia mining counties over two separate transmission lines at 88,000 volts. At various substations this is reduced to 13,000 volts for local distribution. At present the company is operating some 500 miles of transmission line, 237 miles of which is at 88,000 volts. It is serving, or is under contract to serve, some seventy coal mining companies, which operate five, six, seven and up to fifteen mines.

The Logan County Light & Power Company has a new central station, completed within the past year, in the heart of the Guyan Valley coal field. At present sixty-five mines are operated in this field, of which the central station supplies nineteen.

The Tug River Power Company supplies to some twenty mines along the Norfolk & Western Railroad, in the Thacker and Pocahontas coal fields of West Virginia.

In Virginia the Black Mountain Power Company, from its plant at St. Charles, supplies fifteen mines in the Wise and Lee county mining fields.

In Kentucky, the Consolidation Coal Company (previously referred to) maintains a central station for its great new mining plants at Jenkins and McRoberts; also for the mines of the Elkhorn Mining Corporation at Fleming. The Kentucky Public Utilities Company, with headquarters at Lexington, has plants in the Harlan and Bell County mining districts, and in the newly-opened Hazard field.

All New Mines Electrically Operated

Practically all new mines being opened are equipped for electric operation and to purchase power where available. And, at the same time, a large number of companies are discarding their own power plants to purchase from central stations. The reasons for this change are stated as follows:

1. Lower cost of operation.
2. Enables mine operator to "stick to his business"—mining and shipping coal.
3. Reliability of service.
4. Reduced expense when mine is shut down.
5. Leaves capital free for new development and improvements.
6. Increased output and additional power can be obtained with but small increase in capital.
7. No change in speed of ventilating fan or pumps, due to falling steam pressure.
8. Absence of danger from high-pressure boilers.
9. Easy comparisons of power expense per month.
10. Conservation of labor supply.

Most of these points are obvious, but some may be examined in detail, taking first the cost of power.

The cost of power in coal mining is relatively small. In new mines, in nearly all cases, the cost of operation, including interest on investment and depreciation of equipment, is less with purchased power. In old mines, totally different sets of conditions may be presented in each case. In some, a saving would be shown by a change to the use of power from a central station; in others a loss would result. For example: If a mine has a considerable amount of "bone" coal which can be used in a power plant and if this plant has relatively new and efficient equipment, there would be a loss. But if all the coal mined can be sold, and if the individual power plant has reached or is passing its maximum of efficiency, then a saving will be realized by purchasing power from a central station.

The operator of new mines cannot accurately foretell how large a power plant will be required, but is likely to install one with too large a capacity; and this results in idle and useless equipment, ties up funds and thus increases operating costs—the cost per ton of the coal mined. On the other hand, most plants are too small, and the owner is continually calling for an increased tonnage, which cannot be given for lack of power.

Where power is purchased from a central station small units can be installed at the beginning, and as the units are developed additional units can be added at a small expense.

A Typical Cost Comparison

The following is a comparison between the costs of a steam plant and installations for using power from a central station, in a mine to produce from 150,000 to 250,000 tons of coal per annum:

Items	Steam Plant	Central Station
Buildings	$9,500.00	$1,000.00
Foundations	1,000.00	250.00
Boilers, three, 150 hp.	6,000.00	.....
Pumps and piping	2,500.00	.....
Engines, 300 hp.	3,000.00	.....
Generators, 200 kw	3,500.00	*3,700.00
Switchboard	300.00	300.00
Wiring and installation	2,600.00	600.00
Incidentals	2,500.00	600.00
Total	$28,000.00	$6,450.00

*Rotaries or motor-generator set.

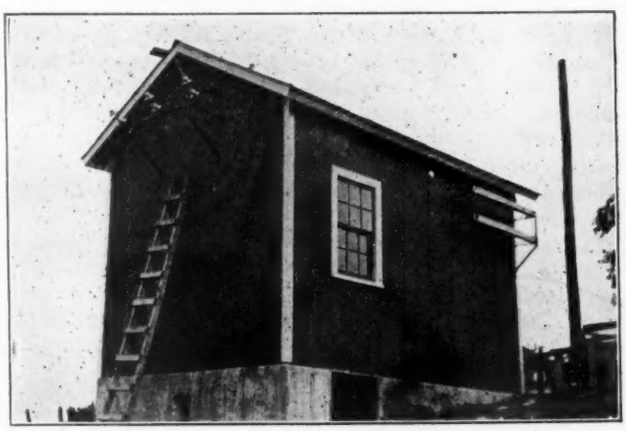


FIG. 3—A SUBSTATION THAT COST LESS THAN $500 TO BUILD

In many cases a substation building can be erected for less than the amount shown above—$1250. Fig. 3 shows one which was built by the Appalachian Power Company in April of this year at a total cost of $489 for all labor and materials. The floor is of concrete, 6 in. thick; the framing of 2-in. by 4-in. lumber, and the sheathing of corrugated iron covered with asbestos.

The next most important reason in the list above is the necessity for spending larger sums in making better living conditions for the employees—in better housing for them, in safety appliances, and in providing better schools and places of amusement and recreation. In the regions here referred to a number of coal mining companies have converted their old power plants—some of them good concrete buildings—into amusement and recreation halls, containing moving-picture theaters, reading rooms, swimming pools and gymnasiums. The new mines not having the initial cost of a power plant to provide for are building better houses for the workmen.

Another improvement in coal mining, and one directly in line with the business of mining coal, instead of the manufacture of power, is the construction of modern tipples, with devices for better cleaning of the coal and loading it without breakage.

COAL MINE LOAD FACTORS

The load factor varies with the different mines and with conditions existing. In individual cases it is as low as 15 per cent, while in others it is as high as 60 per cent. Mines with the greatest amount of pumping to do and ventilating fans of the largest size, of course, have the highest load factor. With respect to diversity factor, however, it has been found that 3 hp. in connected load at the mines requires 1-kw. demand at the power station. The average energy consumption in a drift mine, where the amount of pumping is not abnormal, is about 2.5 kw.-hr. per ton of coal mined.

Although "pick" mining is a method still extensively employed in the regions stated, machine mining has passed it in volume of coal produced; and electrically driven machines to "undercut" the coal preparatory to "shooting" it from the face of the seam have about displaced similar machines driven by compressed air. In West Virginia, for the year 1914, there were 2467 electrically driven mining machines in use in 489 of the 718 mines in the state, producing about 55 per cent of the total coal output. Since then about sixty new mines have been opened, and a large number of the older ones electrified. In the other states nearly all the old mines have been electrified and many new ones opened, each with electrical power and equipment.

A great majority of the mines—fully 75 per cent—are ventilated by fans, electrically driven and motor haulage of coal from the working face to the tipple or headhouse has about displaced the mine mule, except for room work or in driving entries; though even here the storage battery motor is being used more and more.

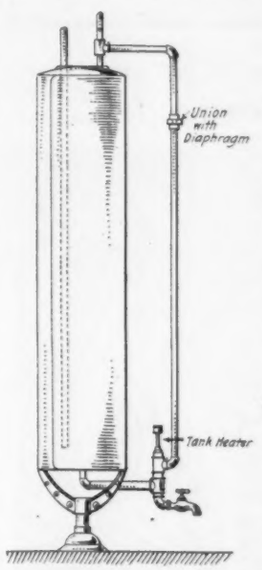
Most of the mines in the Southern Appalachians are in coal beds which crop out in the sides of hills and mountains, and are called drift mines. However, there are some which lie below the surface, and electricity is employed to hoist the coal from the workings. It is also extensively used in pumping water out of the mines and water from deep wells into the tanks in use for supplying the mining towns, for lighting the towns and, to an increasing extent, in the operation of the tipples—the newer types mentioned—to run the conveyor line, to oscillate the screens which separate the coal, and to raise or lower the boom which deposits the coal in railroad cars.

In addition, electricity is employed in the machine shops of the coal companies and for hoisting supplies from the railroad tracks to the mines above.

Equipping a Kitchen Tank for Economical Electric Hot-Water Supply

BY A. R. HAYNES

With the increasing popularity of electric ranges the problem of supplying a satisfactory system of hot-water heating in connection therewith has become of increasing interest. At the present time there are numerous types of electric water heaters on the market, but the problem has been to develop a device with a high load factor so that a low rate for current could be obtained. The consumer, however, when he wants hot water, wants it in a hurry, and is seldom willing to wait a long time for it. The tendency has been, therefore, to design heaters for rather large outputs at the expense of the load factor. This has not only increased the cost of the heater and of the special wiring therefor, but has involved higher rates for energy. Indeed, electric lighting companies are often forced to quote demand rates which are almost prohibitive. This need not be the case, however, in most localities, provided a suitable installation is made.



ELECTRICALLY HEATED HOT-WATER TANK

Tank heaters are generally installed in outside piping so that the ordinary range boiler may be used, as shown in the figure. Obviously both the tank and as much of the hot water piping as possible should be well heat-insulated in order to cut down radiation losses to a minimum.

A USEFUL PIPING "KINK"

A further "kink" is to place a diaphragm in the piping in order to restrict the free circulation of water from the heater, which otherwise would be quite rapid. Without restricted circulation a large amount of water is heated a few degrees only and after a large quantity of hot water has been drawn off from the tank it is a matter of hours with a small-sized heater before the water again reaches a high temperature. But if, with a medium-sized heater of from 750 to 1000 watts, a diaphragm of copper leaf with a hole about ⅛-in. in diameter is inserted in a navy union near the top of the tank, the circulation can be so restricted that water near the boiling temperature will accumulate at the top of the tank and a small amount will be available within a short time after all of the hot water has been drawn off.

A small heater in this way may be run at 100 per cent load factor, storing very hot water between meals and over night. A heater as small as 500 watts which may be attached to any lamp socket—requiring no special wiring—has been found to furnish sufficient hot water for a family of four or five persons when installed in this way. After the household had become accustomed to frugal consumption of hot water, there was seldom any complaint over an insufficient supply. At the rates now being offered by many companies electric water heating is no longer a luxury, especially during the summer months. An electric heater may be installed for use in connection with an ordinary coal or wood range without disturbing the piping in any way.

Wiring and Illumination

Latest Practice in the Electrical Contracting Field and in the Art of Interior and Exterior Illumination

An Elaborate Spectacular Sign with an Advertising Message

ATLANTA'S NEWEST LARGE SPECTACULAR SIGN

The Trio Laundry electric sign at Atlanta, Ga., has caused considerable local interest and comment. The action of the sign is well chosen and draws attention. The flasher starts with the lighting of the ring around the dial of the clock. Next the dragons appear with shimmering wings and tails, spitting lightnings which pass through the lettering at the top. With each flash the following legends are lighted: (1) "Correct Laundering"; (2) "Correct Dry Cleaning"; (3) "Correct Time."

The large figure 3 in the center of the clock with the words "The Trio Laundry" remain lighted, of course, all of the time, as do the hands of the clock and the clock lettering.

This sign measures 45 ft. high and 33 ft. wide, and covers the roofs of two buildings, requiring two separate leases. The clock dial measures 15 ft. in diameter and, like the flasher, was made by Betts & Betts, New York City.

About 2000 5-watt lamps are used. The cost of the sign complete, including the cost of installation, was $4,100. The cost of operating the display is $50 per month, energy being furnished by the Georgia Railway & Power Company.

Complete, the sign weighs 17 tons and special roof construction was required for its support.

F. A. Lansdell designed the sign, the Lansdell lettering being used. The Greenwood Sign Company, Knoxville, Tenn., was the builder.

"Daylight" Lamps Put on Renewal List at Chicago

Effective this month, the Commonwealth Edison Company of Chicago has put blue-glass "daylight" tungsten lamps on its lamp exchange list. These lamps in the 100-watt and 150-watt sizes were formerly sold outright at $1.35 and $1.85 respectively. The customers of the company who are taking its service on the three-step lighting rate of 9 cents, 5 cents and 3 cents, can now obtain the daylight lamps in 100-watt, 150-watt and 200-watt sizes at 70 cents, 90 cents and $1.80 respectively, by bringing in any sort of an incandescent lamp for exchange. The exchange arrangement was made with a view to increasing the use of daylight lighting.

A Kink to Prevent Broken Splices

The kink shown below, declares one contractor, is almost a sure preventive of broken splices. It is used where it is necessary to tap one wire into another be-

A SPLICE THAT WILL NOT PULL LOOSE

tween two knobs or cleats. Instead of winding the "tap" wire around the other in one direction, a loop is formed to the right as shown, and then the wire is wound to the left. If any pull comes on this "tap" the strain is taken up by the loop.

Flood-Lighting Philadelphia's 535-ft. City Hall Tower with 300 500-Watt Lamps

This illumination was installed during the week of the Associated Advertising Clubs' convention at Philadelphia, June 24, but will be made a permanent feature. The installation consists of 300 Independent 500-watt gas-filled tungsten lamps in General Electric projectors. N. A. Holz, city engineer, designed the installation.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

STEEL CONDUCTOR RAILS

British Steel Conductor Rail Practice and Standard Methods of Testing

IN a paper presented before the West of Scotland Iron and Steel Institute, and published in London *Electrical Review* of June 16, 1916, C. H. Ridsdale gives interesting details of British practice with steel conductor rails. According to the British engineering standards committee the resistance of a steel conductor rail is measured in "microhms per 100-lb. yard of the steel being tested."

Steel for conductivity purposes is, or should be, the softest class of steel made. It has a higher density than other ordinary forms of steel, and also very little segregation. In general, the more nearly it approaches in chemical composition to pure iron, the better it is in conductivity. Pure iron has a resistance about 5.81 times that of copper of equal volume.

In view of its special suitability for very soft qualities, one of the earliest applications of basic-bessemer steel was for conductivity purposes, and as far back as 1883 or 1884 the North-Eastern Steel Company of Middlesbrough made it for telegraph wire, and has continued to make it ever since, mainly for conductor rails.

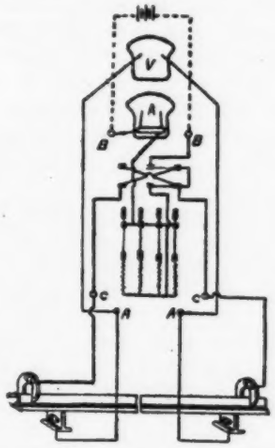


FIG. 1—AMMETER AND VOLTMETER CONNECTED FOR MEASURING RAIL RESISTANCE

Steel wire makers state that its conductivity is not affected by the temperature at which it is rolled or drawn, or the number of rolls required to bring it to a given gage. This corresponds with the author's experience on steel in the mass, for this, say in the form of billets 4 in. square and tested in 5-ft. lengths, corresponds quite closely with tests of the wire after it has gone through the various necessary processes. Rails in the early days were specified to be tested on 20-ft. lengths; a 5-ft. length gives just as accurate results, and this length is now generally accepted. This involves, with what is required for connections, a total length of 8 or 9 ft.

The author describes an apparatus for rail testing which appears to be widely used in Great Britain. It is shown in Fig. 1, where *A* is an ammeter, *C* a voltmeter, *AA* pressure terminals, *BB* battery terminals, and *CC* current terminals. The testing apparatus on the drop of potential system consists of two or more accumulators, each having 120 amp.-hr. capacity, and coupled two in series. A switchboard is used for coupling either the charging current to them or the cables leading to the rail being tested, which are connected with an ammeter registering up to 200 amp. These cables go first to a reversing switch, from which one branch goes direct to the rail, the other through three or four resistances, enabling, say, 40, 60, 80 or 100 amp. to be taken to the rail, as required.

These cables are each branched for a couple of feet at the end, and terminate in flat copper blocks for clamping against the head and foot of the rail with screw clamps. Two knife edges, ground sharp and case-hardened, are mounted on large balks of timber, from which they are insulated by mica sheet. They have under their center a horizontal bolt so as to allow a slight rocking lengthways. The knife edges should be parallel and exactly 5 ft. apart. At each end of these knife edges, and in line and level with them, but with an intervening gap of about 1 in. at each end, are carrier rails on which the lengths of rail to be tested can be stacked. The knife edges are each connected to a small cable leading to one terminal of a double-scale millivolt meter with zero in the center, and graduated in tenths up to 12 millivolts on each side. As each length of rail to be tested is pulled forward onto the knife edges, the sliding motion cuts into its under surface and thus makes a good electrical contact. To facilitate this 4 in. or 5 in. of the under surface of the rail generally are filed bright just previous to testing, and the rail is pulled a few inches backward and forward several times on the knife edges.

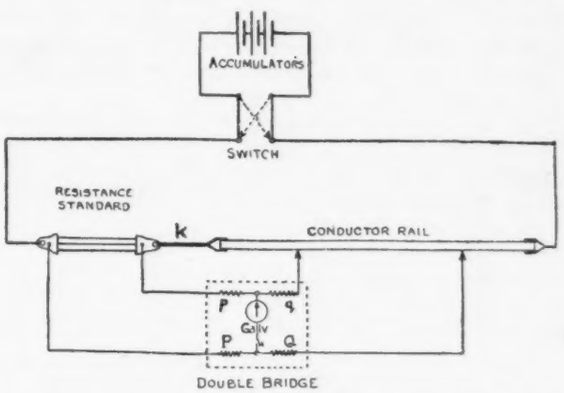


FIG. 2—KELVIN BRIDGE CONNECTED WITH CONDUCTOR RAIL BY KNIFE EDGES

Readings are taken of the current and of the potential difference between the knife edges. From 80 to 100-lb. rails, 60 to 80 amp. is the most satisfactory current. If two or three successive tests of the same piece are made, especially with a large current, it becomes heated appreciably and its resistance increases. Immediately after taking these readings the current is reversed and a second set of readings is taken. These two tests are often repeated as a further check, giving four sets of readings. From the average of these the resistance is

obtained. The temperature of the rail should be taken, both at the beginning of the test and also at its end. A correction may be necessary, both for the rail and for the millivolt meter. The corrections generally specified are 0.5 per cent per degree Centigrade for steel and 0.4 per cent per degree Centigrade for copper.

As illustrating the effect of composition, Table I gives some actual tests, showing side by side the theoretical resistance calculated on the basis and from the factors given.

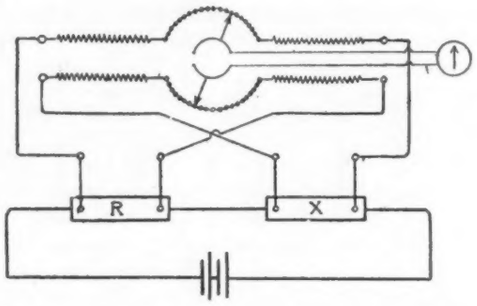


FIG. 3—METHOD OF COMPARING RAIL CONDUCTIVITIES

At the same meeting of the West of Scotland Iron and Steel Institute, S. W. Melsom described the method of the (British) National Physical Laboratory for the determination of the conductivity of steel rails.

The sample tested should be of sufficient length to admit of the current being led in at some distance from the contact points (knife edges). If, as is convenient, the distance between the knife edges is 1 yd., a suitable length for the sample would be 5 or 6 ft.

The sample is weighed, its total length measured, and the weight in pounds per yard computed. A hole in which the bulb of a thermometer can be placed may also be drilled to enable the temperature to be more accurately determined.

For the electrical measurement the rail is connected in series with a suitable resistance standard, the value of which is unaffected by temperature. The current is usually of the order of 100 amp., depending somewhat on the section of the rail.

The contact knife edge and the potential terminals of the resistance standard are connected to the kelvin double bridge, as shown in Fig. 2, which consists of four resistances, two of which, P and p, are equal and usually 100 ohms; the other two, Q and q, are variable over a suitable range of values. The effect of having $Q = q$ and $P = p$ is that the resistance of the connecting piece k is eliminated. Q and q can be simultaneously varied by adjustment of a series of dials. This is done until on making the galvanometer circuit there is no deflection. The value of $Q = q$ is read off, and this divided by $P = p$ and multiplied by the value of the resistance standard gives the resistance of the sample under test, which is independent of the value of the current used.

In some instances, where it is required to compare only such samples as rails of definite weight and length, it is possible that a simple bridge designed by Mr. Melsom would be preferable. For instance, where a steel maker or user required to test samples of a large batch of rails, if the standard R, as shown in Fig. 3, were adjusted to be the specified resistance for a given length of the rail a double dial operated by a single handle, having two sets of twenty studs and varying only a given proportion of the bridge arms, would give the value directly in steps of 1 per cent from 10 per cent high to 10 per cent low.

For a bridge of this sort a reflecting galvanometer is not essential, a portable needle instrument such as is used in steel works for thermo-couple work being amply sensitive for the purpose. Instead of a copper standard it would be much better to use a standard resistance, such as an ammeter shunt, which does not vary appreciably with temperature.

TABLE I—RELATION OF RESISTANCE TO CHEMICAL COMPOSITION

Kind of Steel	Carbon, Per Cent	Silicon, Per Cent	Sulphur, Per Cent	Phosphorus, Per Cent	Manganese, Per Cent	Iron, Etc., Difference, Per Cent	Resistance of 20 Deg. C. of Equal Area, Times Copper	
							By Test	Calculated
Conductivity steel	0.04	Nil	0.06	0.06	0.40	99.44	6.87	*
Ordinary soft steel	0.086	Nil	0.06	0.062	0.49	99.302	7.72	7.73
Medium hard steel	0.24	0.02	0.06	0.05	0.45	99.18	8.58	8.43
Hard steel	0.412	0.028	0.08	0.072	0.92	98.488	1.57	11.67
Hard (high silicon)	0.46	0.336	0.06	0.07	0.07	98.354	3.07	13.07
Hard (low manganese)	0.48	0.06	0.04	0.04	0.36	99.02	9.45	9.31

*Taken as basis.

Generators, Motors and Transformers

Turbine-Driven Alternators.—An illustrated article giving some details of design and construction of British Thomson-Houston alternators, which are standardized in sizes from 1000 to 20,000 kw., for 50 and 60 cycles, and designed to carry continuously their full rated load at any power factor between unity and 80 per cent.—London *Electrician*, June 16, 1916.

Polarity of Transformers.—W. M. DANN.—An article illustrated by diagrams discussing the subject under the following headings: Direction of instantaneous voltages and currents; kinds of polarity; subtractive polarity; additive polarity; subtractive versus additive polarity; standardization of polarity markings; parallel operation; testing for polarity.—*Elec. Journal*, July, 1916.

Lamps and Lighting

Safety Lamp.—F. W. HARDWICK and L. T. O'SHEA.—The first part of a lecture before the (British) Institution of Mining Engineers on the history of the miner's safety lamp. In the present installment the part which W. R. Clanny, George Stephenson and Sir Humphrey Davy played in the development of the safety lamp is discussed. The article is to be continued.—*Iron & Coal Trade Review* (London), June 9, 1916.

Tungsten-Thorium Filaments.—A note on a recent British patent (7829, 1915) of K. Nishimoto. A mixture of finely-powdered tungsten and thorium is consolidated into sticks by pressure, sintered electrically, allowed to cool slowly, and, while at a dull red heat, hammered and rolled.—London *Elec. Eng'ing*, June 22, 1916.

Effect of Wall Paper Colors.—S. G. HIBBEN.—The author discusses the effects of interior colors and finishes upon the lighting of rooms. He gives tables indicating in figures the effect of wall colors and ceilings on table-top illumination, and also tables for the reflecting powers of various colored surfaces and typical room finishes. He emphasizes the great practical importance of light walls and ceilings for interior illumi-

nation. Where diffusing globes are used to illuminate a moderate-sized rectangular room the useful illumination will be increased by a percentage nearly equal to the increase in the reflecting coefficient of the walls. Where semi-indirect bowls are used, the illumination is increased by a percentage roughly one-half that of the increase in wall reflection, and by a percentage equal to or a little greater than the increase in ceiling reflection. Not only must the reflecting values of the ceiling be considered when using indirect or semi-indirect lighting units, but also the wall colors must be reckoned with, for the walls have a larger influence upon the final illumination than is commonly supposed. —*Elec. Journal*, July, 1916.

Units, Measurements and Instruments

Moving-Coil Galvanometer.—PAUL E. KLOPSTEG.—An article in which the author proposes a "current-deflection" method for obtaining the ballistic constants of moving-coil galvanometers, and also discusses possible sources of error. The errors are principally due to non-uniformity of the magnetic field and to insufficient leveling of the instrument. Results of tests of the proposed method are given which indicate that with care the method is reliable to 0.2 per cent accuracy. The suggestion is made that galvanometers to which the method is to be applied be provided with a tangent screw for fine adjustment of the torsion head.—*Phys. Review*, June, 1916.

Design of Critically Damped Galvanometer.—FRANK WENNER.—Attention is called to the fact that galvanometers are used critically damped or approximately critically damped in four distinct classes of measurements, in each of which the sensitivity with which the user is concerned is with respect to a different quantity. In the first, it is with respect to current in a circuit of high resistance; in the second, it is to voltage in a circuit of fairly low resistance; in the third, it is to current impulse in a circuit containing a condenser, and in the fourth, it is to voltage impulse in a circuit of fairly low resistance. A clear distinction is made between these sensitivities and other operation constants in which the user of the galvanometer may be interested, and the inertia constant, the damping constant, the restoring constant, the dynamic constant, and the resistance, these latter being the construction or intrinsic constants with which the maker of the galvanometer is concerned. It is pointed out that for any one of these classes of work the user is concerned at most with but three operation constants, while the galvanometer has five intrinsic constants. Hence, different values for the intrinsic constants may give identical values for the operation constants, or, in the design of a galvanometer to have particular values for its operation constants, values for some of the intrinsic constants may be chosen arbitrarily. It is shown that in all cases the value for the resistance of a galvanometer may be chosen arbitrarily without interfering in any way with the determination of value for the remaining intrinsic constants such that the galvanometer will have the previously selected or specified values for the set of operation constants pertaining to any one of the four classes of measurements. However, in many cases, unless a fairly low value is chosen, there may be difficulties in carrying out the construction. For galvanometers to be used in the detection or measurement of current in a circuit of high resistance or of current impulse in a circuit containing a condenser, it is shown that in addition to a value for the resistance a value for any other one of the intrinsic constants may also be chosen arbitrarily, and values may be calculated for the other three such as will give previously selected values for the operation constants pertaining to either of these two classes of measurements. This is in case the galvanometer is to be critically damped with the winding open-circuited. In case a shunt is to be used to bring about critical damping, corresponding arbitrary choices in values may be made. For galvanometers to be used in the detection or measurement of voltage or voltage impulse in circuits of fairly low resistance, it is shown that when a value is chosen for the resistance in upper limit for the damping constant may at once be calculated. Choosing a value under this limit, values for the remaining intrinsic constants may readily be calculated to give previously selected or specific values for the operation constants pertaining to either of these two classes of measurements. Attention is called to the fact that the higher the sensitivity and external critical resistance, and the shorter the period desired, the smaller must be the inertia constant and the restoring constant. The detail design of a galvanometer, which consists in deciding upon the size and proportions of the magnet; the size, shape and number of turns and size of wire for the winding; the size, shape and kind of material to be used for the suspension, and all such matters, are also considered briefly in the paper.—*Scientific Papers, Bureau of Standards*, No. 273, April 12, 1916.

Traction

Why Modern Motors Are Economical.—At the meeting of the Illinois Electric Railways Association papers were presented on railway motor field control by D. C. Hershberger, on comparative economics of old and new motors by W. A. Clough, and on tests of field control motors by H. A. Johnson, and a valuable discussion followed in which the ability of modern motors to reduce energy consumption and maintenance costs was demonstrated.—*Elec. Railway Journ.*, June 17 and 24, 1916.

Electrochemistry and Batteries

Theory of Lead Accumulator.—CH. FERY.—A French Physical Society paper in which the author proposes the following modification of the double sulphate theory. Only the "negative" plate behaves as assumed in this theory, being *Pb* at the end of the charge and $PbSO_4$ at the end of the discharge, while the "positive" plate is claimed to be Pb_3O_4 at the end of the charge, which is reduced to PbO_2 by the discharge.—*La Revue Elec.*, June 2, 1916.

Electrolytic Copper Refining.—LAWRENCE ADDICKS.—A long paper giving an elaborate analysis of the different sources of metal losses in copper refining. The subject is discussed under the following headings: Weighing losses, sampling losses, assaying losses, slag losses, stack losses, process losses, and handling losses.—*Met. & Chem. Eng'ing*, July 1, 1916.

Telegraphy, Telephony and Signals

Detectors in Wireless Telegraphy.—WILBUR D. BANCROFT.—A discussion of the mechanism by which electrolytic detectors, crystal rectifiers, and coherers are operative. The fundamental feature, according to the author, in all three cases is an absorbed gas film on the surface. The action of the three detectors when subjected to waves is due to the fact that electrical stress decreases the thickness of the absorbed gas film, and therefore decreases the resistance.—*Journ. Phys. Chem.*, June, 1916.

Electric Coupling of Oscillating Circuits.—E. BELLINI.—The method of electrically coupling oscillating circuits (by means of condensers) presents some interesting features which differ in some points from magnetic coupling. The author gives the theory of electric coupling and examines some particular cases.—*La Lumière Elec.*, June 10, 1916.

Attilla Norman has resigned as vice-president and general manager of the Oregon Power Company, Eugene, Ore.

James A. Green has resigned as vice-president and general manager of the Northern Idaho & Montana Power Company.

Gen. Morris Schaff, of the Massachusetts Gas & Electric Light Commission, has received the honorary degree of doctor of laws from Otterbein University.

C. D. Emmons has been appointed general manager of the Boston & Worcester (Mass.) Street Railway. Mr. Emmons was formerly manager of the Chicago, South Bend & Northern Indiana Street Railway.

Robert Montgomery, commercial manager of the Louisville Gas & Electric Company, has been appointed one of the division sales managers in the campaign to secure subscriptions to Louisville's million-dollar factory fund.

F. R. Slater, who has been general superintendent of the Texas Power & Light Company, Dallas, Tex., since 1912, was on July 5 elected vice-president and general manager of the company at a meeting of the board of directors. Since January of this year Mr. Slater has been the acting general manager of the company, following the resignation of George S. Haley. A biographical sketch of Mr. Slater, with portrait, appeared in these columns on March 4, 1916.

Walter Neumuller, special representative of the New York Edison Company, who was unanimously elected chairman of the New York Companies' Section of the N. E. L. A., July 17, is well known among central-station men throughout the country. Mr. Neumuller has taken an active part in many electric lighting and allied organizations, serving for five years as assistant secretary of the Association of Edison Illuminating Companies, as a member of the executive committee and former secretary of the exhibition committee of the N. E. L. A., and as treasurer of the New York Electrical Show Company, and of the New York Electric Vehicle Association. Born in New York City, June 21, 1886, Mr. Neumuller has been connected with the New York Edison Company for 16 years.

WALTER NEUMILLER

Men of the Industry

Changes in Personnel and Position—Biographical Notes

H. G. STOTT

Henry G. Stott, superintendent of motive power for the Interborough Rapid Transit Company, New York City, who underwent a serious operation on July 7, is now reported to be very much improved and assurances are given by his physicians for his early recovery. Mr. Stott, who is a past president of the American Institute of Electrical Engineers, was born in the Orkney Islands, Scotland, fifty years ago, and was educuated in the technical schools of Glasgow and Edinburgh. His first electrical work was with the electric light company at Glasgow in 1884, and in 1885 he was appointed assistant electrician to the Anglo-American Telegraph & Cable Company. Next he became assistant engineer for the Brush Electric Engineering Company's lighting plant at Bournemouth, England. After two years spent at Madrid, Spain, Mr. Stott came to America in 1891 to serve as electrical engineer with the Buffalo (N. Y.) General Electric Company. In his work for the Buffalo company during the ten years from 1891 to 1901, Mr. Stott had charge of much notable electrical construction work. In 1901 he was appointed superintendent of motive power for the Interborough Rapid Transit Company of New York City, and in 1912 assumed the same duties for the New York Railways Company.

Leo Valentine has been appointed local manager for the Ohio Gas & Electric Company at Franklin, Ohio.

B. E. Jack, who for the last two years has been commercial manager of the Salina (Kan.) Light & Power Company, has been appointed commercial manager of the United Water, Gas & Electric Company of Hutchinson, Kan., which like the Salina company is one of the properties controlled by Henry L. Doherty & Company, New York City.

Samuel M. Vauclain, vice-president of the Baldwin Locomotive Works, Philadelphia, and the inventor of many locomotive appliances, has been elected a director of the Westinghouse Electric & Manufacturing Company.

R. H. Rathbun, formerly of Madera, Chihuahua, Mex., has joined the Chicago office staff of the Westinghouse Electric & Manufacturing Company. Mr. Rathbun was formerly chief engineer for the Madera Company.

W. P. Guinan, new business manager of the Danbury & Bethel (Conn.) Gas & Electric Light Company, has been appointed chairman of the mercantile bureau of the Danbury Chamber of Commerce.

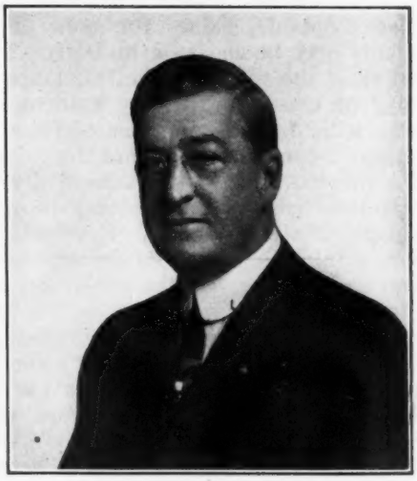
Arthur C. Garrison, general manager of the Columbia Lamp Division of the National Lamp Works of the General Electric Company, St. Louis, Mo., is receiving the sympathy of his friends upon the death of his father, Daniel B. Garrison, a prominent citizen of St. Louis. The elder Mr. Garrison, who passed away on July 4, was formerly vice-president of the Columbia Incandescent Lamp Company.

Obituary

Charles M. Baker, superintendent for the Los Angeles Gas & Electric Corporation at Pasadena, Cal., died at Los Angeles, July 6.

J. H. Sieberling, president of the Indiana Rubber & Insulated Wire Company, Jonesboro, Ind., died at his home, July 7, at the age of eighty years.

J. Harry Pieper, assistant to the general manager of the Southern California Edison Company, died at Los Angeles, Cal., July 11, of heart disease. About a year ago he had an attack of heart trouble, but serious developments in this malady were not expected. Mr. Pieper was formerly a resident of Boston, where he had been in the electrical sign business, but for the last nine years he had lived on the Pacific Coast. Besides his commercial work for the Southern California Edison Company in the electric sign, electric vehicle, and other fields, Mr. Pieper had been prominent in Jovian circles in California.



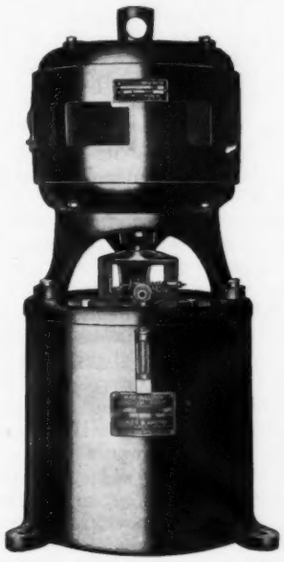
J. H. PIEPER

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Improved Electric Vacuum Pump

The new vacuum pump developed by the May-Nelson Manufacturing Company, Washington, D. C., and shown herewith, is of the oscillating-ring type. It consists of four essential parts—the body, impeller, cover, and shaft—so arranged that the rotation of the shaft imparts an oscillatory motion to the impeller. In the body and impeller are a series of concentric grooves, and each ring so formed dips into a corresponding groove in the other part. The grooves are connected in series by ports, and the action of the pump is obtained by the rolling contact made between the external cylindrical surface of one half and the adjacent internal cylindrical surface of the other half, which pushes the air or vapor ahead of it.



MOTOR-DRIVEN VACUUM PUMP

The pump illustrated differs from the former design described in the ELECTRICAL WORLD for Nov. 13, 1915, in the following features:

Water-cooling, and the piping it required, has been eliminated. In its place the pump is entirely submerged in oil. It is not, however, an oil-sealed pump, as there is no direct connection between the oil tank and evacuating parts of the pump. The oil is used for cooling and lubrication only.

All bearings are lubricated automatically from the oil tank, and no attention whatever need be given them, the maker points out.

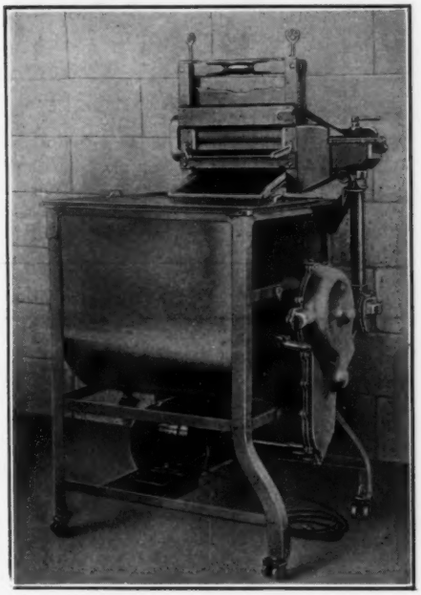
A new device is applied to the shaft which automatically keeps the impeller at the minimum point of clearance with the body, compensating for wear, and eliminating the necessity of adjusting the clearance occasionally by hand.

The stuffing box has been eliminated, a feature which makes the pump especially suitable for handling dangerous gases.

The pump will produce a vacuum of 0.05 mm., and has a displacement of 3 cu. ft. of free air per minute. It is equipped with a Robbins & Myers 0.5-hp. motor operating on direct current or alternating current, as required.

Motor-Driven Washer and Wringer

The "Gainaday" electric washer and wringer shown herewith is built on the safety-first principle, all revolving parts being incased so that danger to the operator is obviated. All gears are packed in a heavy lubricant, and no oiling is necessary, it is asserted. Oil and grease cannot get into the washer, it is furthermore pointed out. The machine is operated by a motor, which is insulated from the washer so that there is no danger of shock. The washing machine is of the well-known cylinder type, and is operated by a 0.25 hp. Westinghouse motor, which drives both washer and wringer, and which is protected by a metal guard. A convenient lever on the side of the gear case is used for starting the washer. The wringer is thrown in operation by means of a lever on the upper gear case.



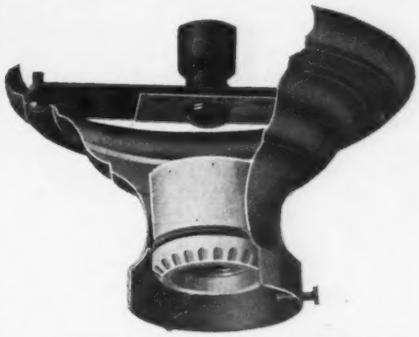
ELECTRIC CYLINDER WASHER

The washer is equipped with a sturdy copper tub, in which a perforated zinc cylinder, weighing only 16.75 lb., revolves back and forth. Due to this revolving action, and the hundreds of smoothly perforated holes in the cylinder, the hot water and suds are forced through the meshes of the clothes. There are five smooth cypress baffles in the cylinder, which aid this action without the slightest wear on the clothes, the maker points out. Being made of zinc, the cylinder will not corrode, and it is lighter than the wooden ones, which warp and get out of shape. The strong cylinder doors are easily opened when putting in or taking out clothes.

The wringer, which is of the revolving type, can by means of a special catch be placed in a stationary position at three different points, thereby lessening the work about the wringer. In the first position the clothes can be run from the cylinder to the rinse water. Another lot of clothes is then put into the cylinder, and, while being washed, the first lot can be wrung into the bluing water with the wringer in the second position. In the third position, the clothes can be taken from the bluing water and wrung out into the basket. The washer is being placed on the market by the Pittsburgh (Pa.) Gage & Supply Company.

Ceiling Ring Designed for Quick Installation

The Beardslee Chandlier Manufacturing Company of Chicago is marketing a new quick-action ceiling ring which they say is so designed as to make a great saving in time and labor in installing. It consists of a steel bar in the center of which is a hole of the proper diameter, and spring clips which may be forced over the thread on the conduit stud at the ceiling, instead of screwing the plate on and afterward fastening the ceiling ring to the bar, as is done in ordinary practice.



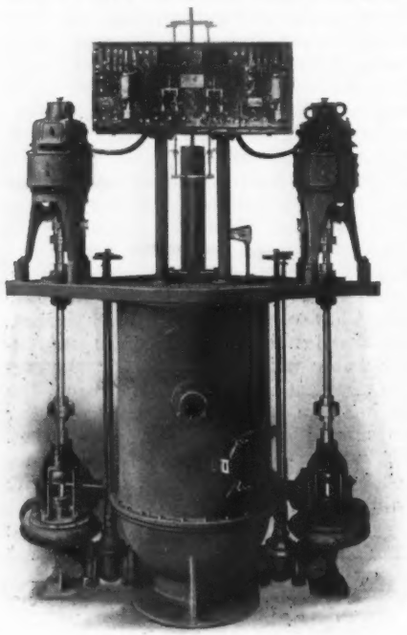
QUICK-ACTION CEILING RING

To install this device the two screws

which fasten the ring to the pipe bar are loosened, but not removed, and the wire attached to the socket inside the ring. With the thumbs on the screws, the ring is then given one thrust upward, when the spring clips engage the thread on the end of the stud. The screws are then tightened to bring the ring up snugly against the ceiling, and the device is in position. It cannot be removed except by unscrewing in the usual manner.

Motor-Driven Centrifugal Sewage Ejector

In the accompanying illustration is shown a Form A duplex electric sewage ejector, as it is called, which is being used in many high-class office buildings

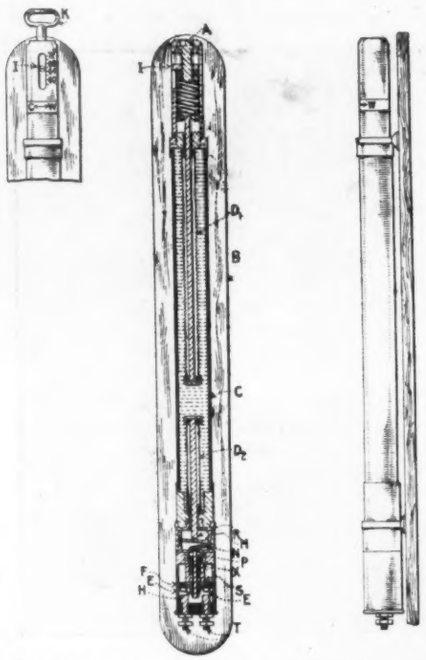


ELECTRIC SEWAGE EJECTOR

and sewage pumping stations throughout the country, the maker points out. The equipment consists of a cast-iron sewage receiver in the center of a dry pit, built of concrete, or of steel imbedded in concrete, into which are connected all low-level sewers which will not drain by gravity into the street sewer or other outlet. In the annular space between the receiver and the ejector pit are two centrifugal pumps with suctions connected to the bottom of the receiver, and discharge connections brought together with long turn fittings and valves to a double-branch connection. The pumps are directly connected to vertical motors supported at the floor level by a heavy cast-iron plate which also forms the cover of the receiver. The motors are controlled by a float running in an 8-in. pipe casing inside the receiver, and operating automatic starters mounted on panels on top of the receiver, as shown in the illustration. The machine is being built in capacities ranging from 200 gal. to 1000 gal. per minute from both units. The pumps are so arranged that the casings can be opened up for cleaning or inspection without disturbing the shafts or bearings, and clean-out and manhole openings are provided on the suction connections and sewage receiver. A cast-iron screen 3 ft. in diameter is provided on the inside of the receiver, and the design of the receiver is such, the manufacturer states, that there is no possibility of accumulation of solids, as in the case of submerged sump pumps. The Yeomans Brothers Company, 231 Institute Place, Chicago, Ill., is placing the ejector on the market.

Thermo Switch

The Sarco Company, Inc., Woolworth Building, New York, maker of a temperature regulator for steam, water, and gas valves, has designed and is marketing a modified type of regulator to operate an electric switch. This new apparatus combines the expansion element of the ordinary "Sarco" regulator with a specially designed switch, as shown in the accompanying sketch. It is intended to furnish a means of operating electrically a switch for controlling a supply of energy for heating or a motor for distribution of hot air, or for any other purpose requiring the control of an electric circuit by temperature changes.



DIAGRAMMATIC VIEW OF TEMPERATURE REGULATOR AND THERMO SWITCH

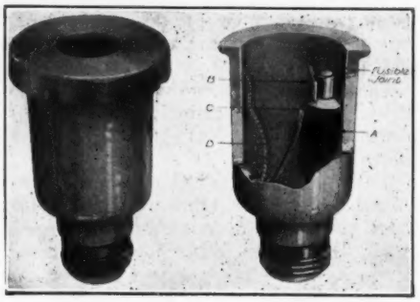
The instrument shown in sketch has a calibrated scale from 58 deg. to 78 deg. Fahr., and is intended to operate the switch with a change of approximately 2 deg. in temperature. It can be constructed for any temperature up to 325 deg. Fahr. The operating mechanism employs a brass tube filled with a heavy hydrocarbon oil, which, on expansion, compresses a spiral tube inserted in the oil. This spiral tube, which is the same as that used in "Sarco" steam traps and temperature regulators, is capable of withstanding pressures up to 2000 lb., but a special safety device is furnished, in the form of a heavy steel spring in the regulating head. The expansion element pushes a rod out of the end of a tube by the expansion of a liquid derived from increase in temperature. The movement is multiplied by levers. A motion is obtained sufficient to operate the snap switch even with very slight changes in temperature.

The diagram shows the instrument in the "hot" position, with the plunger extended. As the instrument changes to "cold" position, the rod *R* is slowly withdrawn into the tube, followed by the plunger, *P*, which operation is based upon the action of the spring, *X*. The insulating member carrying the switch blade, *F*, is held in its illustrated position by the brass seat against which it rests; therefore, the plunger head, *H*, is withdrawn slowly through this insulating member, expanding the spring, *S*, which is an endless coil spring, free to roll from one end to the other of the plunger head, carrying with it the insulating member which carries the switch contacts. As the plunger draws through this switch member the spring, *S*, expands, and as the point of greatest diameter of the plunger head passes through the center of the spring, *S*, the compression of the spring, *S*, causes it to travel down the plunger head, carrying with it the insulating member carrying the switch arms, which then hop over and locate themselves on the terminal posts, *T*, thus closing the circuit. This condition then obtains until the process reverses itself by application of a warmer temperature.

The switch can be safely operated on a 220-volt direct-current or alternating-current circuit, with currents up to 5 amp. Its action is very quick and positive, it is asserted. The device will work with lamps in series without causing a flicker.

Time-Element Protective Plug for Induction Motors

The plug, an outside view and broken section of which are shown herewith, is designed for protecting induction mo-



EXTERIOR AND BROKEN SECTION OF PROTECTIVE PLUG

tors against continued overloads. It requires no special mounting, as it may be screwed into an ordinary receptacle in the motor circuit. The protective plug contains a stationary contact post, with the heating coil, *A*, and the fusible link, *B*, which binds the spring contact

arm, *C*, to the stationary plug. When the plug is installed for service, the heating coil, link, and spring contact arm are in series in the motor circuit. Thus, when a large current exists long enough to heat coil, *A*, and thereby melt the link made of low-fusing alloy, the spring contact arm is released, and takes the position shown by dotted line, *D*, thereby opening the motor circuit. The spring cannot be restored to its normal position without installing new links, which can be obtained from the General Electric Company, the manufacturer of the protective plug. Owing to the time lag in the heating coil, momentary inrush of starting current will not cause the plug to open the circuit, but continued overload would seriously overheat the motors, thereby causing interruption. The plugs may be applied so that they will open the circuit when the multi-phase motor is energized with single-phase energy and when an attempt is made to start stalled motors or serve motors carrying too heavy a load.

Elliptical Angle Reflectors

Angle reflectors, which, the manufacturers say, will distribute light evenly over either vertical or horizontal surfaces without requiring any exceptional preparations for installation, are being marketed by the Benjamin Electric Manufacturing Company, 120-128 South Sangamon Street, Chicago, Ill. Several sizes of reflectors have been developed covering the entire range of commercial lamps. The unit illustrated herewith is for 750-1000-watt lamps. The reflector recommended for smaller rated lamps is very similar in outward appearance, but is equipped with differently shaped sockets, and the shade is made to accommodate a smaller bulb. The reflectors are made of porcelain-enameled steel. A copper hood is provided for larger lamps to permit circulation of air around the lamp base and sockets. The socket is a two-piece, easy-to-wire porcelain device, which contains a patented spring arrangement to hold the lamp firmly against the contact even during extreme vibration. Photometric tests on the distribution of

ANGLE REFLECTORS FOR 750/1000 WATTS REFLECTOR DESIGNED FOR LAMPS RATED AT 500 WATTS OR LESS

light from the elliptical angle reflectors have shown that the maximum intensity exists at 35 deg. to the vertical and 40 deg. to the horizontal. This distribution has the effect of building up the illumination at points generally weak; that is, midway between units.

The units are particularly applicable to the lighting of large open areas such as signs and billboards, bathing beaches, tennis courts, and athletic fields. Indoors, they are especially adapted to lighting foundries, erecting shops, large mills of various kinds, or in any place where it is not possible or desirable to hang the lighting units directly over the area or work which has to be illuminated. This applies directly to places where traveling cranes are used.

Improved Electrolytic Lightning Arresters

Two improved forms of electrolytic lightning arresters have been developed by the Westinghouse Electric & Manufacturing Company, and are illustrated herewith. The type *A* arrester which is shown in Fig. 1 is designed for voltages up to 2450 and is furnished for indoor mounting only. The type *AK* arrester which is represented in Fig. 2 can be used on circuits operating at 2000 volts or more and is particularly suitable where generators are to be

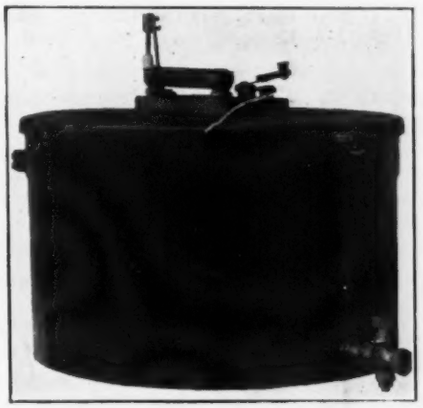


FIG. 1—INDOOR TYPE OF ALUMINUM CELL ARRESTER FOR VOLTAGES UP TO 2450

protected. While designed for direct-current service in railway or lighting power generating stations and substations, the type *A* arrester with spark gap may also be used for low voltage alternating current installations. It is similar in construction to the type *AK* except that no charging resistance is required. The oil in which the trays are immersed, it is declared, will cool the tank under all possible operating conditions. Since the aluminum plates exposed to the electrolyte are about twice as large as those of other alternating current aluminum arresters, this arrester has an exceedingly high discharge capacity. Mounted on top of the tank is a fuse and a gap for insulating the arrester from the line. This gap can be easily short circuited for charging purposes, which operation should be performed once a day. The gap can be closed when the arrester is operated on direct current but in this case the leakage current disintegrates the aluminum trays, thereby giving shorter life than when the gap is used.

The type *AK* arrester consists of nested, double-cone aluminum trays supported on porcelain and secured in frames of treated wood. The electrolyte employed is inorganic and it is claimed has the advantage of being more stable chemically, less affected by heat, and causes less dissolution of the film between charging periods than

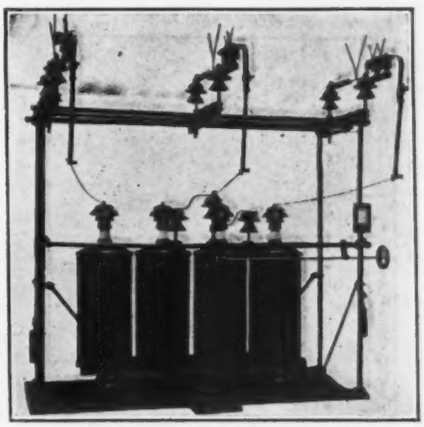


FIG. 2—INSTALLATION OF OUTDOOR TYPE ELECTROLYTIC ARRESTER SHOWING MECHANISM FOR OPERATING HORN GAP SWITCHES

most electrolytes on the market. A ventilating duct is provided in the center of each tray stack to facilitate the circulation of oil. Bakelite micarta, which is impervious to moisture, has been employed to line the tank. Charge and discharge resistances are provided on all arresters.

For outdoor service, the type *AK* arresters are provided with special insulating bushings, all other details being the same as for the indoor arresters. Being equipped with horn gaps the outdoor type arresters cannot be designed for less than 10,000 volts because the horn gaps would be so close together that they would be short circuited by rain. Bridging of the gap, which is required during charging, is accomplished on the indoor type arresters by tilting one horn of each pair until a phosphor bronze strip attached to each movable horn comes in contact with the corresponding horn and short circuits the gap. The movable horns are restored to their normal position by a spring. The gap between horns is adjusted by setting a stop on the horizontal bar that turns each pair of horns on its axis. No disconnecting switches are required because separating the horns to the limit afforded provides the gap necessary for isolating the equipment. The charge and discharge resistors which are connected between the main horn gap and the arrester, consist of rod resistors in parallel with a series of small spark gaps. Small horns are provided at each end of the series spark gaps to break the arc which forms between them. The resistor is made of "Koppat," a substance which remains practically uniform under all conditions of service. One resistance rod and one shunt gap are used on the low-voltage arresters, while two of each are employed on the higher voltage types.

Motor-Driven Wheel Chair for Street Use

Illustrated herewith is a motor chair similar to those which dominate the boardwalks of Atlantic City and Florida winter resorts, but designed for street service. The bodies are built

MOTOR CHAIR AS IT LOOKS ON THE STREET

of metal, oak or rattan and are supported on solid rubber-tire wheels having ball bearings. Other than standard models can be built to individual order. The motor chairs are equipped with standard Exide 12-volt, 150-amp-hr. batteries which together with the motor and controller are mounted on substantial running gear. The motor-driven chairs are being marketed by the Motor Chair Sales & Operating Company, Westminster Building, Chicago.

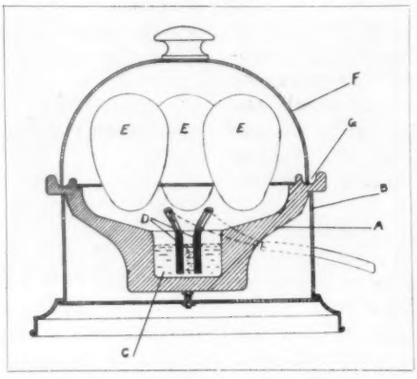
Cooking Device That Operates on Electrolysis Principle

A cooking device which depends upon the heat developed by electrolysis of water rather than on that produced by the resistance of wires, has been placed on the market recently by the Ruvio Electric Company, 50 Broad Street, New York City. The device is used principally for cooking eggs but may be utilized for warming nursing bottles. Since the food placed in the device is cooked or warmed by the steam generated by electrolysis of water and is not immersed in the water itself, only a small amount of water need be heated, consequently the energy consumption is relatively low. Furthermore, the amount of water may be adjusted so that it will be entirely converted into steam at the end of a definite period, thus automatically shutting off the current and preventing overcooking of the food.

The device consists of a nickel-plated base, *B*, in which rests a porcelain dish, *A*, having a dome-shaped cover. In the center of the dish is a small well, *C*, which serves as a receptable for the water which is to be converted into steam by electrolysis. To prevent the formation of metallic salts, carbon electrodes are employed. The groove *G*, in which cover *F* rests, is of sufficient capacity to hold as much water as the well *C*. Thus, as the water is evaporated and then condensed by cover *F* it will be deposited in the groove *G* and not permit the device to continue operating indefinitely. A perforated metal plate resting on the top of the porcelain dish is provided to hold eggs while they are being cooked.

The device is operated as follows: A definite quantity of water, depending on the length of time the food is supposed to cook, is measured in a receptable furnished with the device and poured into the well *C*. The receptacle is graduated in lengths of time the device is desired to operate. Holes, which may be covered by the fingers, are provided at different points, so the measure may be filled to the desired level easily. When the water is poured into the receptacle *C*, current will pass between the carbon electrodes, causing the water to boil almost immediately. The resistance of the water is reduced by the absorption of salts, with which the carbon electrodes are impregnated. Thus salt never has to be added to the water to make it a conductor.

It may be pointed out that not more than 1½ teaspoonfuls of water need to



CROSS SECTION OF EGG COOKER OPERATING ON WATER RHEOSTAT PRINCIPLE

be boiled to cook four eggs, as compared with the kettle full when using other methods. The improved economy must therefore be obvious. To insure cooking the eggs uniformly regardless of size or number, the tray holding them is arranged so that the steam condensed on the surface of the eggs will run back into the well *C*. As soon as their surfaces become heated to the temperature of the steam, however, condensation will no longer occur on their surfaces but will take place on the inside of the cover and will run down into groove *G*, where it will remain. Thus the water will finally be deposited in the groove and the current automatically turned off.

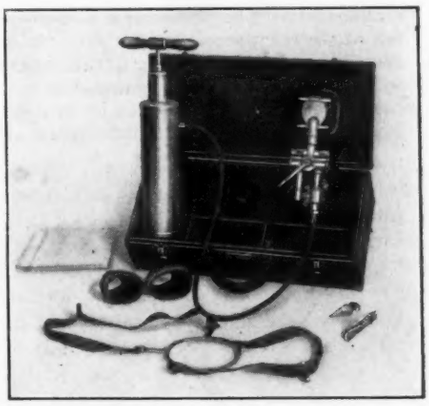
This device may also be used for warming nursing bottles. With this method it is declared impossible to burn or scorch the milk, and, furthermore, it is unnecessary to watch the milk while it is warming. Other applications for this form of electric heater are being developed by the Ruvio Company, since it is apparent that it can be applied to all sorts of steam cooking as well as warming liquids and sterilizing material by steam.

Mechanical Respirator

A mechanical respirator that is light and compact, making it ideal for emergency work, is being placed on the market by the Draeger Oxygen Apparatus Company of Pittsburgh, Pa. Unlike many hand-operated respirators on the market, this one operates on the measured-pressure principle instead of on the measured-volume principle. A special pressure valve, adjusted by the operator, who stands at the patient's head, is used to control the air pressure employed in producing inhalation or exhalation from the patient's lungs. The control is so positive, the manufacturer declares, that the operator may be certain of exerting the exact pressure desired at every stage. Since the rate of breathing is not dependent upon the pumping action, the pump does not have to be operated continuously.

So long as the pressure desired by the operator is furnished, the pump need be operated only occasionally to maintain this pressure. To insure uniform artificial respiration the operator at the valve opens or closes the lever in synchronism with his own breathing.

The pressure that is being exerted on the patient's lungs is indicated on a gage near the pressure control valve. By observing the reading of this gage while using the respirator people of different strengths and lung capacity can be dealt with safely. Other features claimed for the respirator are that the valve prevents gagging of the patient and the gage indicates resumption



DEFINITE-PRESSURE MECHANICAL RESPIRATOR

of normal breathing. This respirator, which is known as the Type B Pulmotor, weighs complete in a substantial carrying case about 4 lb. It is completely equipped with all necessary accessories and is accompanied by full instructions. Oxygen tanks can be used in place of the pump if desired.

NEWS OF THE INDUSTRY

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

NEW WATER-POWER LEGISLATION

House Substitute for Senate Bill Governing Dams on Navigable Streams, in the Hands of Conference Committee

The House of Representatives on July 14 passed a substitute measure for the Senate (Shields) bill for regulating the construction of dams across navigable waters. The measure is now in the hands of a conference committee composed of Congressmen and Senators. There was some disappointment on the part of the conservationists over the decision to send the bill to conference, but others are somewhat relieved because they apprehend that unsafe legislation might result if an attempt should be made to jam the measure through just before adjournment. The bill will probably not be reported out of the conference for two or more weeks.

The new measure is not unlike the Adamson bill in many respects. It requires the prospective power developer to secure the consent of Congress, and it is incumbent upon the grantee to construct, maintain and operate without expense to the United States, a lock or locks, booms, sluices, or any other structure or structures which the Secretary of War and the chief of engineers or Congress at any time may deem necessary to the interests of navigation. Like the Adamson bill, the present House bill provides that not more than 50 per cent of the output of any plant shall be sold to one customer except upon the written consent of the Secretary of War.

In this bill it is stipulated that the rates, charges and service shall be reasonable and just, and that the regulation and control of so much of the service and of charges for service to consumers as constitutes commerce between the States or in any territory and of the issuance of stocks and bonds by the grantee is conferred upon the Secretary of War or committed to such body as may be provided by Federal statute. In valuations for rate-making purposes, there may be considered any lock or locks or other aids to navigation and all other capital expenditures required by the United States, but no values shall be claimed or allowed for the right granted for good-will or any other intangible value. Like the Adamson bill, the present measure also stipulates that no sale of energy shall be made to a distributing company except in case of an emergency without the written consent of the Secretary of War.

The bill provides for a permit period of fifty years, and at the expiration of the grant the United States or any person authorized by Congress may take over the dam or diversion structure and locks and properties used by the grantee for the generation and transmission of electrical energy, which are dependent for their usefulness on the continuance of such grants upon six months notice of intention to do so. It is provided that by "transmission" there shall be understood the wires, conduits, poles, or other devices used to convey electrical energy to the point of its application, but that nothing shall obligate the United States to purchase any property beyond such generating plant and transmission lines. It is provided, also, that the United States may purchase at its discretion lands and other property of any grantee acting under the terms of the act as in the judgment of Congress may be deemed advisable upon condition that it shall pay before taking possession, first, the reasonable value not exceeding the actual cost of the dam or diversion structure, and locks and all other aids to navigation constructed under the approval of plans and specifications, rights of way, water rights, lands and interests therein purchased or taken over by it; and second, the reasonable value of all other property taken over including structures and fixtures acquired, erected or placed upon the lands and included in the generation or transmission plant, such reasonable value to be determined by mutual agreement between the Secretary of War and the grantee or owners of such property. The reasonable value, however, shall not include or be affected by the value of the franchise or good-will or profits to be earned on pending contracts or any other intangible element.

Where, in the judgment of the Secretary of War, the public interest acquires or justifies the execution by any grantee of contracts for the sale and delivery of water-power or electrical energy for a period extending beyond the life of the grant, but for not more than twenty years thereafter, such contracts may be entered into upon the approval of the Secretary. The bill reserves the right to Congress to alter, amend or repeal the act, and provides that the grantee shall be entitled to no indemnity for damages occasioned thereby.

CONVENTION OF OHIO ASSOCIATION

New Plan of Grouping Subjects Finds Favor at Four-Day Meeting at Cedar Point

A four-day convention of the Ohio Electric Light Association opened at Cedar Point on Monday. The first day was executive and public policy day. Tuesday was technical day, Wednesday was commercial day, and Thursday, the final day, was largely given over to addresses of general interest and to association business. That this plan of grouping subjects did not work to the detriment of convention attendance is shown by the fact that nearly 400 delegates were registered at the end of the second day.

The place of first importance at the public policy meeting was assumed by the report of the illumination committee on street lighting contracts under Chairman S. E. Doane. This report, in accordance with recommendations made at the 1915 convention, presented tentative specifications to accompany street lighting contracts, which specifications were written after all available Ohio contracts and all contracts outside Ohio known to possess features of excellence had been analyzed and discussed by the committee. When the specification, which had been printed, was read it evoked a long debate and was referred back to the committee with the recommendation that ideas brought out in the discussion be considered for incorporation in the specifications and a report be made at the next convention.

In the round table meeting on executive and public policy subjects J. C. Martin of Columbus suggested that the following State legislation be enacted for the benefit of the companies, the customers and the public at large: A statute requiring municipal as well as pri-

vately owned plants to adopt a standard form of accounting; a change in the definition of the term "Public Utility" to include in it the municipal plants; a law making certificates of public necessity obtainable to lighting and power companies, and a statute granting indeterminate franchise or permits.

Speaking on "Municipal Ownership, Its Shades and Shadows," D. L. Gaskill ascribed the growth of the municipal plant business to the hesitancy of capital in entering the business in small towns, to poor service formerly given in some places, to street lighting contract disputes and to high maximum residence rates.

The morning session of the second day was occupied by the presentation and discussion of the reports of the station operating committee and the committee on transmission and distribution of electrical energy. The former consisted merely of a resumé of the past year's work.

The report of the latter committee was an engineering treatise covering in a general way the experience of Ohio companies as to what are the best methods and materials to use in transmission and distribution work. Under the heading of transmission the following topics were treated: Switches, choke coils, fuses, lightning arresters, transformers, future developments, and cost data. Under distribution the subjects treated were urban distribution problems, feeder systems and station feeder equipment.

In the enthusiastic discussion which followed representatives of several manufacturers pointed out the rapidly increasing use of outdoor substations.

At the afternoon meeting on Tuesday addresses were presented by W. W. Freeman on "The Public Policy of a Utility," and by E. Burt Fenton of Sandusky on the "Missing Link."

"Every public utility should have a clearly defined policy," said Mr. Freeman. "That policy should be known to the public and to the companies' employees alike. The public, as a general rule, is fair, and if a company has a public policy that can be explained it will gain a fair hearing with the public."

The speaker concluded by suggesting that the association, not immediately but as soon as possible, give some consideration to a plan for obtaining legislation to give the State Utilities Commission original jurisdiction in rate adjustments since the present practice is cumbersome and unsatisfactory. He also asserted that the utility interests should assume a position of dignity, and from that position ask for adequate legislation to protect their vast investments in the State.

Bringing Engineers into Civic Affairs

The benefits that may attend the concerted action of all local sections of engineering societies under one head and as one body were pointed out by A. M. Schoen of Atlanta, Ga., at the recent Cleveland convention of the American Institute of Electrical Engineers. To indicate what has been done in this line, Mr. Schoen called attention to the good work that the Affiliated Technical Societies of Atlanta has performed in bringing engineers out of their shells and sending them before the public as prominent and dominant factors in civic affairs.

The association idea was conceived about three years ago, and as now made up the organization includes mechanical, chemical, electrical, illuminating, civil and mining engineers, architects who are members of the various national societies and the Engineering Association of the South, a strictly Southern society. All of the members are affiliated through their respective local society sections except mining and illuminating engineers, who have no local sections. These members are affiliated through the civil and electrical engineers' society sections respectively. The Affiliated Technical Societies of Atlanta does not interfere with the individuality and integrity of any of the national bodies representing these classes of engineers, since it takes up only those problems which are of vital mutual interest, thus serving more as a joint committee. To prevent any one society's influence dominating the association's affairs the administration is vested in an executive committee to which committeemen are appointed by the member societies. The executive committee in turn elects its own chairman. When money is needed to support the association each member society section is assessed. Meetings are held quarterly, each member society being given the opportunity of supervising the meeting once every eighteen months. Business men are invited to these meetings, and popular topics are discussed to awaken interest in engineering subjects.

Whenever important civic matters come up the member society sections are promptly and effectively assembled to discuss the subject. Politics is mixed in only when engineers may be concerned. For instance, the city engineer, electrician, building inspector and superintendent of waterworks at Atlanta are elected by popular vote. Recognizing the weaknesses of such a system the Affiliated Societies served a notice that it is their desire that these offices be filled by civil service examination. In addition two engineers have been placed on city boards and the Governor of the State has been requested to consider appointing an engineer to the Sanitary Board of the State. In reply to the latter request the Governor has stated that the thought had never occurred to him before, but that he would be glad to consider the appointment. The results which have been obtained by the Affiliated Societies of Atlanta indicate that a similar service can be performed elsewhere to advantage. A. M. Schoen, chief engineer of the Southeastern Underwriters, has been chairman of the executive committee of the Affiliated Societies of Atlanta since its formation and active in all its work.

Association of Edison Illuminating Companies' Convention

The 1916 convention of the Association of Edison Illuminating Companies will be held at "The Homestead," Hot Springs, Va., from Sept. 4 to 7. Arrangements for this occasion are fast being completed, and the present outlook for a successful meeting, it is stated, is most promising.

The business program, following the procedure of last year, will be arranged so as to group similar subjects at the different sessions, thus allowing ample time for both presentation and discussion. One session will be largely devoted to general discussion of technical problems following the presentation of the reports of the steam and electric plant committees, and will conclude with a demonstration of original ideas on "Better Lighting; Its Possibilities for Customer and Central Station," by W. A. Durgin.

The printed report of the lamp committee, containing the latest information pertinent to lamp matters, will be presented by the chairman, John W. Lieb, and with a paper by Peter Junkersfeld on "The Control of Incandescent Lamps," will be open for free discussion. The subject of street lighting and the committee's report will be considered at this session.

The session on rates and sales will be opened with the report of the residential service rate committee by its chairman, Alex Dow. R. S. Hale will present a paper on intensive methods of meeting private plant competition, and the balance of the session will be devoted to

a general open discussion of any features of central station rate making.

An attractive entertainment program is being arranged, particular attention being directed toward pleasing the ladies and young people. Several new features are included and the entire schedule is so planned as not to conflict with the business sessions. The past presidents and their wives will receive the members and guests on Monday evening, after which there will be dancing. On Wednesday afternoon a Southern luncheon will be served at Fassifern Farm, the entire convention making the trip from "The Homestead" by carriage or on horseback. Following the luncheon there will be horse racing and an opportunity to view a fox hunt of the Fassifern Hunt Club. The convention will close on Thursday evening with an informal banquet, following which the prizes will be presented and the new officers installed.

NIAGARA POWER DIVERSION

House Committee on Foreign Affairs Visits the Falls and Hears of Need for More Power

Members of the Foreign Affairs Committee of the House of Representatives, who reviewed the power situation at Niagara Falls and Buffalo, N. Y., July 13-14, as guests of the Niagara Falls Board of Trade and Buffalo Chamber of Commerce, were impressed with the urgent necessity for increased diversion of water for power purposes. Officials of electrochemical industries and power companies were given assurances that the committee is in sympathy with the movement for increased diversion so long as the scenic beauty of the cataracts would not be impaired.

In the party of Congressmen were Cyrus Cline of Indiana, J. C. Linthicum of Maryland, W. S. Goodwin of Arkansas, B. P. Harrison of Mississippi, Charles B. Smith of Buffalo, A. J. Sabath of Illinois, J. W. Russell of South Carolina, George Huddleston of Alabama, J. B. Thompson of Oklahoma, J. J. Rogers of Massachusetts, H. W. Temple of Pennsylvania, G. E. Foss of Illinois, C. B. Milo of Minnesota and L. W. Mott of New York. Others in the party were L. W. Garner of Texas, Stephen G. Porter of Pennsylvania and Bennett Clark, son of Speaker Clark.

After informal conferences with officials of electrochemical industries, power companies and city authorities, the committee held a hearing at Prospect House in Niagara Falls at which a mass of statistics were presented which tended to show the need for the extension of the diversion limit to 20,000 sec. ft. as fixed by treaty. Some urged diversion up to 50 per cent of the cataract's flow as possible without impairing the scenic beauty of the river and as necessary for the full development of the industrial arts of the nation.

F. A. J. Fitzgerald of Niagara Falls, president of the American Electro-Chemical Society, said that Niagara diversion was a subject of the utmost interest to every section of the nation, adding that it is not a local question but affects the industrial life of the country because the products of Niagara electric furnaces and cells have become essential in almost all the industrial arts.

F. Austin Lidbury, manager of the Oldbury Chemical Company, said that if it had not been for the development of the electrochemical industries of Niagara Falls the European war would have brought upon the United States the greatest panic it has ever known. The steel plants, Mr. Lidbury said, would have been forced to close down if they had not been able to obtain the ferro-alloys produced by the local industries. He urged increased diversion as national industrial and military preparedness.

Frank J. Tone, manager of the Carborundum Company, pointed out that all the ferro-silicon used throughout the United States at the present time is produced at Niagara Falls. It is an alloy essential in the steel industry. Other alloys produced in Niagara industries are essential in the manufacture of heavy armor plate and for high explosive shells. He said that last year more than 80,000,000 tons of aluminum were produced at the Falls, but the supply is far below the demand. Mr. Tone declared that increased diversion was absolutely necessary so that industries could obtain more power to increase their output. It was also pointed out by Mr. Tone that Niagara Falls has become the seat of the industrial abrasive industry of the world, but lack of power has greatly curtailed the increased development of this industry. Mr. Tone told how the Carborundum Company was forced to construct a plant in Canada because of the shortage of power on the American side of the river.

The great need for increased diversion for power purposes was told by A. H. Hooker of the Hooker Electro-Chemical Company, who said that if the products of the electric furnaces were cut off most of the industrial plants throughout the country would be forced to close down. Such a condition, he pointed out, would cause a nation-wide panic.

The creation of a joint commission representing manufacturers of the United States and Canada to review the Niagara power situation was advocated by I. R. Edmands of the Union Carbide Company. The purpose of this joint commission proposed by Mr. Edmands would be to determine how much water could be diverted for power purposes without impairing the beauty of the falls and to determine the most efficient method of development, with the idea of eventually reporting terms for a new international treaty. It was the belief of Mr. Edmands that if a submerged dam were constructed above the falls, 50 per cent of the river's flow would be diverted without injury to the scenic beauty. He said that the Horseshoe Falls is destroying itself for want of such a dam.

Dr. Edward G. Acheson, who gave carborundum and artificial graphite to the world, reviewed the Niagara power question from the earliest development of power on the river. Dr. Acheson went to Niagara Falls in the early days because he needed an abundance of power to develop commercially the products of his inventions. He said that without an almost unlimited amount of power the production of carborundum and artificial graphite and other allied products would not now be known to the industrial world.

All Niagara Falls electro-chemists are hopeful that Congress will at this session extend the diversion limit to 20,000 cu. ft. per second. Representative Cline has a Niagara bill which would practically extend the life of the present Burton act, limiting diversion to 15,600 cu. ft. In discussing the situation informally with Niagara Falls officials Representative Cline indicated there is a changing sentiment in the foreign affairs committee on the Niagara power question.

"Because of the disposition on the part of Canada to curtail the exportation of power there is a feeling on the part of the committee that the new Niagara legislation should extend the diversion limit to that provided by the treaty," said Mr. Cline.

After the Niagara Falls hearing, the committee made an inspection of the properties of the Niagara Falls Power Company and the Hydraulic Power Company, and also visited the up-river districts where all the great electrochemical industries are located. In the evening the party made a tour of the Niagara gorge and viewed the American and Canadian cataracts under the new powerful Western-Davis flood lighting system.

Public Service Commission News

District of Columbia Commission

A compromise to expedite the hearings of the Potomac Electric Power Company's objection to the official valuation set upon its plant has been announced by Engineer Commissioner Kutz, acting chairman of the Public Utilities Commission. The commission's experts and those of the company will get together on the two reports of valuation that have been made, and will eliminate all items on which they can agree. The disputed points only will be taken up by the commission.

The commission also receded from its previous announcement that the power company must prove its valuation figures, by stating that its engineers and experts will be placed first on the stand for the purpose of giving evidence as to the methods adopted in arriving at the results set forth in the report of the engineering and accounting departments.

Illinois Commission

The Illinois Northern Utilities Company, a corporation serving some forty-six municipalities in the northwestern part of the State, has been authorized by the Public Utilities Commission to consolidate with its properties the plant and equipment of the Tri-County Light & Power Company, operating in some thirteen municipalities just southwest of the Northern Utilities' territory, and the plant and equipment of the Freeport Railway & Light Company, a utility operating in the city of Freeport, just north of the Illinois Northern territory. The consolidated capital stock totals somewhat more than $8,000,000, par. The greater part of the stock of all three utilities is owned by the Middle West Utilities Company—a holding company. The market value of the Illinois Northern Utilities Company is normally in excess of the two smaller corporations. It was admitted by the petitioners that all three companies are over-capitalized, but it was maintained that the public in the northwestern part of the State will be greatly benefited by the consolidation, resulting in a stronger organization.

In order that the public be adequately warned that the issuance of securities is not based upon proved values of tangible property, the Illinois commission, in approving the consolidation, required the consolidated corporation to print upon each share of stock issued the following proviso:

"The Illinois Northern Utilities Company is a corporation formed by consolidation of the Illinois Northern Utilities Company, Tri-County Light & Power Company and Freeport Railway & Light Company, as authorized by the State Public Utilities Commission of Illinois, by its order of May 31, 1916, and the amount of stock by said order authorized to be issued on such consolidation was fixed at $8,191,300 (being an amount equal to the aggregate outstanding stock of the constituent corporations), without investigation by said commission of the value of the assets of said corporations."

In a rate case at Jacksonville, Ill., involving gas, electric, and street railway rates, the State Public Utilities Commission of Illinois, in an order dated July 11, 1916, found the total for present values to be as follows: Gas department, $200,000; electrical department, $190,000; street railway department, $175,000; total, $565,000. The commission found a reasonable and fair rate of return to be 7 per cent per annum upon the above valuations, and found the depreciation which should be set aside annually to be: Gas department, 7.5 cents per 1000 cu. ft.; electric department, $8,500, plus 4 per cent of cost of additions; street railway department, $99,000, plus 4 per cent of cost of additions. Several schedules of rates for gas, electric and street railway service were fixed.

In support of its order the commission reaffirms its position, taken in the Springfield gas case, on subjects such as overhead expenses, depreciation, going value, fair value of the property, rate of return, and rate of depreciation. In addition, the commission discusses certain features of the Jacksonville case, which were not discussed in the Springfield case.

In regard to the separate entity of the gas, electric, and street railway business of the company, the commission says:

"In a case such as the one at bar, where two or more services are furnished under one general management, questions of the allocation of property and operating expenses frequently arise. Equity does not demand that the consumers of one service should be called upon to bolster up the revenues obtained from the users of another class of service. It is axiomatic that, in all fairness, a person should pay for only what he receives, and a user of water, for example, should no more be called upon to help in the upkeep of an electric light plant owned by the same company, than he should be expected to contribute to the revenues of an independently-owned electric company whose product he does not use. To hold otherwise would be to countenance a form of unfair discrimination. The principle applies to the distribution of property between the several departments of a combined utility. Since each service must stand upon its own feet, it must be permitted to earn a return upon all property that properly belongs to it. To assign the property of one department arbitrarily to the service of another might result in grave injustice, inasmuch as the department from which the property is subtracted may thereby be deprived of a return thereon, a result that is clearly confiscation.

"Doubtless economies may be effected through the combined operation of several plants, but are not the consumers entitled to participate in the resulting benefits? This commission has before it the determination of rates for properties operated under a stated form of management which has been in effect for many years previous to this proceeding, and it is not reasonable to suppose that a rate should be predicated upon a different basis of management merely because such method of operation may be possible. To predicate a finding upon conditions which may be imagined to exist instead of those which are in actual operation is to enter the realms of conjecture, a basis affording no footing upon which to base a rate structure."

Upon the subject of accruing depreciation, the commission says:

"The general tendency of utilities involved in a rate-making procedure is to argue that either nothing or some merely nominal amount should be deducted from cost-new figures to cover past, or accrued depreciation. Almost in the next breath, strenuous arguments will be advanced for a liberal allowance to cover the depreciation that will take place in the future. In general this commission cannot hold that there be one rate for depreciation in a property for the time that has passed, and another for the time that is to come, with the date of the rate proceeding as the dividing line.

"That depreciation should be taken into account in the proper management of a public utility, or similar property, seems to admit of little argument. Lack of consideration of the fundamentals involved has many times placed the affairs of such corporations in the hands of receivers. Proper provision to care for depreciation is so well agreed upon among students in economics that it becomes almost superfluous to quote authorities. The necessity for such an allowance has frequently found official and judicial recognition."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Flaming Arc Electrode.—To produce a flaming arc between titanium and calcium compounds which shall be unfluctuating in color and yet not suffer from unsteadiness Joseph L. Haden, in a patent, No. 1,190,162, suggests employing a steadying compound such as potassium biborate in one of the electrodes, whereas the light giving material itself is to be employed in the other electrode.

Enlargement of Municipal Light Plant at Columbus, Ohio, to Be Considered.—It is said that an ordinance will soon be submitted to the City Council providing for the expenditure of $265,000 in the enlargement and improvement of the municipal plant so that it will be able to undertake commercial and residential service. An attempt will be made to begin the work by Aug. 1 or as soon thereafter as possible.

New Use for Electric Disk Stove.—The new business department of the Denver Gas & Electric Light Company has evolved a new use for an electric disk stove. At St. Luke's Hospital in Denver a great many vapor baths are given, and the nurses have been using a gas hot plate for generating the necessary steam. This has been very unsatisfactory on account of fumes and other features, but an experiment proved that the disk stove was exactly what was needed proving satisfactory in every respect.

Fees for Signs at Toledo.—The special revenue committee of the City Council of Toledo, Ohio, has approved an ordinance which will require the payment of fees for the erection of signs and signboards and for their annual inspection after being erected. For illuminated and electric signs the fee will be 5 cents per square foot, with a minimum charge of $1.50. All signs exceeding 20 sq. ft. in area will be subject to an annual inspection, for which fees of 1 cent per square foot, with a 50-cent minimum, will be charged.

No Agreement Reached in Buffalo Strike.—The New York State Department of Labor, who held hearings on the strike of electrical workers in Buffalo, N. Y., which has been in effect for several months, has reported that the agreement between the Electrical Contractors' Association and Local Union No. 41 of the Electrical Workers, has been technically violated but was not of a serious nature, and suggested that the contract be again placed in force. No agreement, however, has been reached. Members of the Electrical Contractors' Association of Buffalo involved in the strike are the Buffalo Electric Company, the Buffalo Electric Constructing Company, Bison Electric Company, Inc.; McCarthy Bros. & Ford, Inc.; the Robertson Electric Construction Company, Sterns Electric Equipment Company, and the Johnson-Wahle Electric Company. The Electric Shop, Inc., which held membership in the association, has retired from business.

Washington Water Power Conference.—A two-day water power conference was held in Tacoma, Wash., July 11-12, at which time delegates from all over the State of Washington came together to discuss a new water rights code, to govern the power resources of the State. This code is to be presented for passage to the next Legislature. The speakers included Governor Ernest Lister of Washington; President Henry Suzzallo, University of Washington; Prof. O. L. Waller of the Washington State College at Pullman; John H. Lewis, State Engineer of Oregon, and Ralph B. Williamson of North Yakima, Wash.

Detroit Edison Company to Remodel Office Building.—At the termination of a lease which the Detroit Edison Company has of the premises occupied as its central office building at Washington Boulevard and State Street, the company plans to exercise an option it holds for the purchase of the property. With a frontage of 70 ft. on Washington Boulevard and a depth of 110 ft., the corner is occupied by a four-story brick building. Its value is estimated at $315,000. The Edison Company will remodel the building to provide larger accommodations for handling the 140,000 customers who make monthly payments there.

Flood-Lighting for Freight Piers.—Flood lamps are being used at freight piers by the Goodrich Transit Company, a Great Lakes steamship company, for loading and unloading its boats, according to a recent issue of the *Valve World*. The projectors are mounted on the ships and operated from energy generated therein. This method of illumination has been found very convenient because the piers are usually inadequately lighted and are difficult to illuminate by any other means. These lamps are also found serviceable in following loads when they are being lowered into the hold by the freight loading booms.

Large Crowd Present at Indianapolis Office Warming.—Approximately 7000 people, attracted by advertised offers of souvenirs and by a desire to see a new electric store spectacularly opened, viewed the warming of the Merchants Heat & Light Company's new office and salesroom at Indianapolis, Ind., on July 11. Until the time of opening at 8 p. m. the building was not lighted, but at the appointed hour, with the crowd assembled and waiting for the event, the flood lamps directed at the flag, all of the lights in the building, the electric roof sign, the flood lighting of the building extension, and the company slogan sign at the first floor were flashed forth. The doors were then thrown open to the public and favors were distributed as the people passed through the salesroom.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

West Virginia Public Utilities Association.—The semi-annual meeting of the Public Utilities Association of West Virginia was held at the Chancellor Hotel, Parkersburg, W. Va., on July 12, 13 and 14.

Meeting Place of New England Convention Changed to Pittsfield, Mass.—The eighth annual convention of the New England section of the National Electric Light Association will be held at Pittsfield, Mass., Oct. 17 to 20 inclusive, instead of at Lenox, Mass., as previously announced. Headquarters will be at the Maplewood Hotel.

Cleveland Electrical League.—The annual picnic of the Cleveland (Ohio) Electrical League took place at Nela Park on July 15, when about 2500 members and their friends gathered there for a day of enjoyment. One of the principal features was a play, "Nearly a Duchess," in which members and others took part. Fancy dancing also held a prominent place in the entertainment. Many electrical articles were given as prizes.

Portland, Ore., Sections A. I. E. E. and N. E. L. A.—The Portland sections of the A. I. E. E. and the N. E. L. A. held their regular monthly joint dinner meeting on July 11 in the Electric Building in Portland. Following the regular program, the members of the Portland section of the Institute considered a new draft of the by-laws. M. E. Cheney, representing the Washington Surveying and Rating Bureau, spoke on "Scientific Construction of Utility Insurance Rates."

New York Companies' Section, N. E. L. A.—The third annual convention of the New York Companies' Section of the National Electric Light Association was held on July 17 in the auditorium of the Irving Place and Fifteenth Street Building, New York City. A report of the season's activities was presented, officers for the ensuing year elected, and a thorough discussion was had of the various reports presented to the several sections at the recent Chicago convention. Those elected for the season of 1916-1917 were: Chairman Walter Neumuller of The New York Edison Company; vice-chairman, Edward B. Fielis of the New York and Queens Electric Light & Power Company; treasurer, G. B. Cornell of the Yonkers Electric Light & Power Company; executive secretary, J. F. Delahant of The New York Edison Company; recording secretary, S. H. Giellerup of The United Electric Light & Power Company; executive committee, Carleton Macy, J. E. Phillips, Alexander Maxwell, F. W. Smith, J. P. Radcliff, E. J. Murphy and F. C. Henderschott.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

LARGE SALES OF PORCELAIN WIRING SUPPLIES

Scarcity of Labor Handicaps Many Manufacturers in Turning Out Larger Quantities of Their Product

Recent demand for standard porcelain wiring supplies has far surpassed that of the two previous years. To a certain extent this is owing to the larger stocks being carried by jobbers and contractors to tide over the longer deliveries of the present time. Since the beginning of the year, however, there has been a healthy growth in construction throughout the country which would naturally be reflected in sales of all kinds of wiring supplies and devices, including porcelain.

In a large number of cases the output has by no means been an index of the demand. Had manufacturers been able to turn out standard porcelain in the quantities desired the 1916 output would be double that of 1915. Unfortunately this is not possible. The principal handicap to larger production is labor. Besides demanding greatly advanced wages, labor is scarce and unstable. Prices have naturally soared because of this and the higher cost of all manufacturing materials. Late deliveries of raw materials are quite common so that orders are not filled as promptly as formerly.

Credits and collections were never better than they are at the present time.

LARGE STOCKS BREED CREDIT SUSPICIONS

Poor Deliveries Necessitate Increased Stock Which Must Be Held Until Lower Prices Release Flood of New Construction

Ever since the buying movement set in motion by the flood of war orders began in this country there has been a wild scramble by manufacturers for raw materials and by tradesmen and jobbers for the finished product. Almost the only word known to buyers of late has been "delivery." Where formerly salesmen went out to the trade buyers are now going to the producer. So delayed have deliveries been that jobbers and dealers who must under any conditions keep an appreciable supply on hand have had to double their entire stock in many instances in order to be able to furnish customers with prompt deliveries, thus increasing the demand on the manufacturer and resulting in much higher prices and poorer deliveries. The demand has not been entirely indicative of the retail market which, after all, is the real test of business prosperity. Nor has the buying altogether reflected what the retail market will consume. In fact, in some quarters there is every reason to believe that the retail consumption of certain kinds of electrical goods, especially construction material, will be retarded for some time. Many people are not building because they believe at prevailing prices of materials they can well afford to wait.

However, it is not likely that prices will slump off as soon as the feverish buying for necessary construction is completed or shows signs of waning. It will be some months afterward before factories complete the orders so far booked and begin to work at less than maximum capacity. Until that time there is little likelihood of producers making any concessions in price. The first concession will probably have to come from the handlers of the raw materials, principally iron, steel, copper and the other metals. Nominally this has already happened but even these nominal prices are still far above prices in normal times. Many months must therefore elapse before the ultimate consumer can expect to obtain any appreciable price concessions.

Jobbers and dealers who have stocked up in anticipation of increased new construction must still carry their stock. This eats into profits, and the result on the manufacturer is evident. With the jobber and dealer stocked up far in excess of the demand, capital is tied up, interest charges accumulate and bills are paid less promptly. To the manufacturer this situation is becoming serious. Liberal credit is being extended only where there is positive information to show that the buyer is not overstocking. Where overstocking is suspected the most rigid credit terms are imposed and every effort is made to induce the buyer to place a smaller order.

MOVEMENT FOR LAMP VOLTAGE STANDARDIZATION

Tungsten Lamps to Be Manufactured for Operation on 110, 115 and 120 Volts, Discontinuing Odd Sizes

Although in the early years of incandescent lamp manufacture it was impossible to accurately predict before the lamp was manufactured at what voltage it would operate most efficiently, with the introduction of the drawn-wire filament lamp it became possible to accurately foretell at just what voltage any and all of the output shall be rated. Lamp manufacturers, therefore, are now in a position to standardize their output and to bring about economies in the manufacture, distribution and utilization of lamps. Among the many benefits which it is expected will accrue from this standardization of incandescent lamp voltages there are others besides those of manufacture. With a smaller number of sizes jobbers and dealers with the same investment naturally will be able to carry lamps for a greater variety of services. Also there will no longer be any necessity on the part of central stations of maintaining domestic service voltages at other odd pressures.

All of the affiliated lamp manufacturers have co-operated in this movement, it is understood, although but one company, the National Lamp Works, will try it out. Should the results justify, it is understood that all of the manufacturers are prepared to adopt the same voltages which, after a careful analysis of the National output, were placed at 110, 115, 120 volts.

This movement is but another step in the standardization of electrical materials. Once upon a time there were dozens of different kinds and varieties of lamp bases, whereas now the medium screw base is almost universal. Sockets have been standardized; so have wires, cables, motors and a thousand other things electrical, with great resulting economies to the public, the distributor and the manufacturer.

Owing to the large number of carbon filament lamps on the market it has not been possible to start this movement until the present time. Carbon lamps, however, are having a decreasing demand, and the volume of sales is but a small fraction of the total output of incandescent lamps. It is impossible to manufacture carbon filament lamps to a certain predetermined voltage without finding a wide scattering of voltages in the resulting product. Carbon filaments have to be fired in furnaces and there is a decided lack of uniformity in the rating of filaments when they have been through the various processes of manufacture. To-day the situation is radically different. Tungsten lamps

can be manufactured to a predetermined voltage rating with very little reduction of "off" voltages. This is due to the fact that the filaments are of drawn wire, of uniform diameter and composition, and this wire can be gaged very accurately for length in mounting.

FEW LARGE ORDERS BOOKED FOR ELECTRICAL GOODS

High Cost of Construction Materials Is Holding Back Large Volume of Buying—Inquiries Continue

One of the outstanding features of the present market for electrical goods has been the absence of numerous orders for large quantities of material. To be sure, there have been some large orders but these have been principally brought on by the boom in metals. Iron and steel rolling mills have bought large quantities of electrical goods in single orders, but they were practically forced to it.

But the large development projects scheduled for erection about this time have been held up, wherever possible, until more favorable times. Those plants that are in the course of construction undoubtedly have either been absolute necessities owing to the condition of the load and the load expected or else were projected and orders placed previous to this general advance in prices.

All construction costs have advanced many per cent. Labor, besides being more expensive, is very scarce. Copper wire for transmission lines has advanced to an almost prohibitive price owing to the demand for copper by the warring nations. Practically all electrical equipment, including the necessary steam and hydro machinery, costs considerably more to-day than before the war.

Although orders of large volume have been infrequent there have been many inquiries for quantities of goods that would run into millions of dollars. All of these inquiries, it is more than likely, will develop into bona fide orders as soon as the price is satisfactory. It is well known that there is a vast amount of railroad electrification awaiting lower prices. One of the large eastern roads has laid plans for extending its electrified zone, but is hesitating to do anything definite at the present time because of the abnormally high prices.

It is significant that the greater part of the buying of electrical goods during the recent months has been by industrial concerns, factories, mills, etc. There is therefore to be expected, it is believed, as soon as prices warrant, a buying movement from the other large purchasers, the central stations and railroads.

PHENOMENAL GROWTH OF ELECTRIC SALES

Three Largest Distributers of Electrical Goods During Past Sixteen Years Turn Out Goods Valued at Over Two Billion Dollars

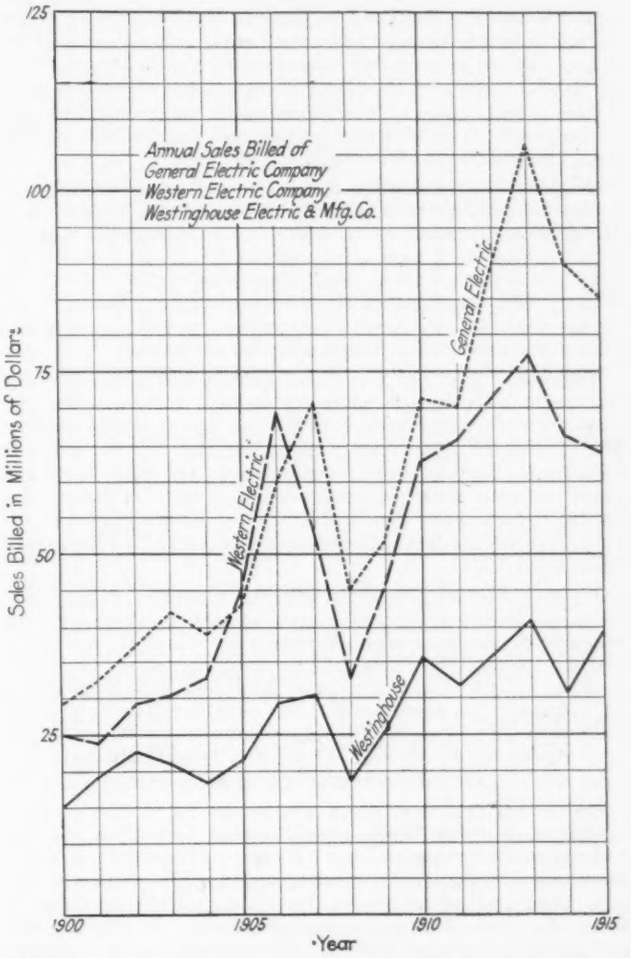
During the last sixteen years the aggregate sales billed by the three largest distributors of electrical goods in the United States has amounted to $2,191,937,000, or an average of approximately $137,000,000 annually. The total for the General Electric Company was $963,899,000; Western Electric Company, $792,800,000; Westinghouse Electric & Manufacturing Company, $435,238,000. The accompanying curves show graphically the annual variation in the sales of these three companies starting with 1900.

It will be noticed that while the general tendency has been upward, the curve for each company contains more than one inflection. Furthermore, in each case it will be noticed that the slump in sales billed followed a particularly good twelve months. In 1907 the sales of the General Electric Company were the largest on record, but in the following year the sales were almost on a level with those for 1905. Again the 1913 sales took a jump to $106,477,000, which was almost $20,000,000 greater than any previous year. In 1914 but $90,468,000 worth of electrical goods were sold.

The same condition is true to a different degree of the other two companies except that the Western Electric Company had a record year in 1906 and a slump in 1907. The 1906 Western Electric sales billed were $69,000,000 and the 1907 sales billed were $53,000,000. The 1913 sales billed were $77,500,000 and the 1914 sales billed amounted to $66,400,000.

Sales billed by the Westinghouse Company in 1907 were $30,325,000 and in the following year $18,216,000. In 1913 they were $40,741,000 and in 1914 but $31,208,000.

In 1911 both the General Electric and Westinghouse Companies billed smaller sales than in 1910, but the Western



ANNUAL SALES BILLED BY THREE LARGEST DISTRIBUTORS OF ELECTRICAL GOODS

Electric Company's sales increased by $3,000,000. The 1910 sales of the General Electric Company were $71,479,000 and of Westinghouse $35,622,000. The 1911 sales of these two companies were $70,384,000 and $31,223,000 respectively.

The largest year in the history of the three corporations was 1913. In that year the sales billed by the three companies were as follows: General Electric Company, $106,477,000; Western Electric Company, $77,500,000; Westinghouse Electric & Manufacturing Company, $40,741,000; a total of approximately $225,000,000.

Both the 1908 and 1914 slumps were attendant upon international financial depressions. The year 1907 opened with a liquidating movement following a year of extraordinarily good business. Before the year was ended affairs had reached such a point that credit was suspended, and in this country a panic broke out. In this latest depression it is not difficult to understand why business should fall off when with the greater part of the civilized world at war and international commerce practically suspended, financial operations were suspended and money was both expensive and hard to obtain.

Manufacturing and Industrial

New Quarters for Betts & Betts Corporation.—Growth of business has necessitated the Betts & Betts Corporation which is now located at 256 West Fifty-fifth Street, New York City, to move to larger quarters. On or about Aug. 1 this company will be located at 511-513 West Forty-Second Street, New York.

Hamilton-Beach Manufacturing Company, Racine, Wis., announces that W. Harvey Kelley has been appointed chief of the company's free service advertising staff. Mr. Kelley's merchandising and advertising experience covers a period of seventeen years, including three years with the Julius Andrae & Sons Company of Milwaukee, and four years with the Western Electric Company.

Exide Storage Battery Company to Make Cleveland a Distributing Point.—Julius Tuteur has arranged to erect a building at Chester Avenue and East Twenty-fourth Street, Cleveland, Ohio, on which the Exide Company has already secured a fifteen-year lease. The company will make Cleveland one of its principal distributing points, and this building will be used as a service station and shipping plant.

National Lamp Anniversary.—The fifteenth anniversary of the establishment of the National Lamp organization and the fifth anniversary of its becoming a part of the General Electric Company were celebrated at a banquet held at Association Island during the evening of June 29. O. D. Young, vice-president of the parent company, was present at the banquet, and commented on the growth and progress of the National Lamp Works since its formation.

Increasing Demand for Fuses and Switch Boxes.—There has been a continually growing demand for fuses and inclosed switch boxes in the last three months according to W. F. Hassell, New York agent for the Detroit Fuse & Manufacturing Company. Considerable business has come from concerns with munition orders as well as other companies which have overloaded their plant equipment to take care of the unusual demand represented by increased orders.

Kelman Electric & Manufacturing Company of Los Angeles, it is reported, has closed up the electric washing machine department of its business, having sold its electric washer patents, business and goodwill to the P. A. Geier Company of Cleveland, Ohio, which concern, it is understood, is preparing to manufacture the electric washer in large quantities and to conduct an aggressive sales campaign all over the country. Kelman Electric & Manufacturing Company will continue the manufacture of high voltage switches and circuit breakers.

Chicago Surplus Stocks and Materials Listed.—The Civic Industrial Committee of the Chicago Association of Commerce has issued a booklet which gives a list of all manner of articles and materials available for immediate shipment from the stocks of its member companies. In this list are included small lots of braided weatherproof copper wire and magnet wire, transformers, a switchboard, a rather long list of small and medium sized motors, a small turbo-generator unit, one large alternating-current motor, x-ray bulbs, a magnetic separator and other electrical material and apparatus.

Hoover to Increase Output by 300 Cleaners per Day.—The Hoover Suction Sweeper Company of New Berlin, Ohio, is building a new factory which it is expected will be ready for occupancy about Sept. 1. The new building will measure 80 ft. by 85 ft. and will be three stories high. An effort is being made to make this building not only the last word in factory efficiency, but of pleasing exterior finish through the use of tapestry brick. With the present plant the company can put out 140 machines per day, but with the new factory in operation the daily output, it is estimated, will reach 440 machines.

Century Electric Branches.—A notice has been sent to the trade by the Century Electric Company, St. Louis, Mo., which reads as follows: "We respectfully request that in the future you send all orders for Century apparatus to the nearest branch office named below. These sales offices have recently been established with the object of caring for the requirements of our customers who are located in that territory, in a more satisfactory manner. A substantial stock of such motors as there is a reasonable demand for will usually be found in the warehouses at both Cleveland and Detroit. The offices are in charge of experienced Century representatives, who will be pleased to promptly supply you with information of either an engineering or sales character pertaining to Century apparatus." The branch offices are at Cleveland, Ohio, in the Rockefeller Building, and at Detroit, Mich., in the Dime Bank Building.

C. A. Hoppin, with R. A. Carlson, has organized the firm of C. A. Hoppin & Company, engineers and constructors, Peoria, Ill., formerly incorporated as Hoppin & Rich. Mr. Hoppin is president and Mr. Carlson is vice-president of the new firm which plans to do mechanical and electrical engineering, construction and contracting work, specializing in the application of industrial and power equipment. Mr. Hoppin, who graduated from the University of Illinois in 1901, for a time served as erecting and sales engineer for the Allis-Chalmers Company, and was later identified with the larger turbine and engine installations in and about New York City. From 1907 to 1913 he was chief engineer and later general superintendent of the Peoria Gas & Electric Company. In 1913 he entered the partnership of Hoppin & Rich, the business of which firm is to be carried on by the new company. Mr. Carlson is an electrical engineering graduate of the University of Michigan, class of 1912, and since completing the graduate student course of the Westinghouse Electric & Manufacturing Company, has been engaged in the industrial sales and engineering work in the Chicago office of the Westinghouse Company.

Approved Electric Equipment for Coal Mines.—The latest Permissible Bulletin containing a list of the electric equipment for coal mines approved by the Bureau of Mines is as follows: Permissible Portable Electric Mine Lamps.—Approval No. 10 covers a permissible portable electric mine lamp manufactured by the Edison Storage Battery Company, Orange, N. J. The only bulbs approved for use with this lamp are the symbol 26-V bulbs manufactured by the Independent Lamp & Wire Company, New York City; the symbol BM-10 bulbs, manufactured by the National Lamp Works of the General Electric Company, Cleveland, Ohio, and the symbol BM-10 bulbs, manufactured by the Edison Works of the General Electric Company, Harrison, N. J. Approval No. 11 covers a permissible portable electric mine lamp manufactured by the Mannesman Light Company of America, New York City. The only bulbs approved for use with these lamps are the symbol C-5 bulbs sold by the Mannesman Light Company of America. Approval No. 12 covers the Concordia permissible portable electric mine lamp manufactured by the Concordia Safety Lamp Company, Pittsburgh, Pa. The only bulbs approved for use with these lamps are the symbol Osram 08510 bulbs sold by the Concordia Safety Lamp Company. Explosion-Proof Coal-Cutting Equipment.—Approval No. 100, covering a 250-volt direct-current explosion-proof coal-cutting equipment manufactured by the Sullivan Machinery Company, Claremont, N. H. Approval No. 100A, covering a 500-volt direct-current explosion-proof coal-cutting equipment manufactured by the Sullivan Machinery Company, Claremont, N. H.

NEW YORK METAL MARKET PRICES

	July 11 Selling Prices Bid	Asked	July 18 Selling Prices Bid	Asked
	£ s d		£ s d	
London, standard spot*	88 0 0		88 0 0	
Prime Lake	26.00 to 26.50†		25.50 to 26.00†	
Electrolytic	25.50 to 26.00†		24.50 to 25.00†	
Casting	23.50 to 23.75†		22.75 to 23.25†	
Copper wire	29.00		28.00 to 29.00†	
Lead	6.50		6.50	
Nickel	45.00 to 50.00		45.00 to 50.00	
Sheet zinc, f.o.b. smelter	17.00		15.00	
Spelter	8.92½		9.17½ to 9.42½	
Tin, straits	38.50		37.75	
Aluminum, 98 to 99 per cent.	57.00 to 59.00†		57.00 to 59.00†	

OLD METALS

Heavy copper and wire	17.00 to 17.50†	19.00	to 19.50
Brass, heavy	10.50 to 11.00†	11.25	to 11.50
Brass, light	8.50 to 9.00†	9.00	to 9.50
Lead, heavy	5.00 to 5.25†	5.25	
Zinc, scrap	8.00 to 8.25†	6.00	to 6.50

COPPER EXPORTS

Total tons to 15,235

†Nominal.

Corporate and Financial

Cities Service Company, New York, N. Y.—At the special meeting held recently, stockholders approved an increase in the authorized capitalization of the company to $60,000,000 of 6 per cent preferred stock, and $40,000,000 of common stock, this being an increase of $20,000,000 in preferred and $15,000,000 in common stock from present authorized amounts. At present the company has outstanding $34,530,217 preferred and $18,058,826 common stock. Of the unissued preferred and common stocks a part will be issued soon to provide for the acquisition of the comman and preferred stocks of Toledo Traction, Light & Power Company, the preferred stock of Electric Bond Deposit Company, and the capital stocks of Lincoln Gas & Electric Company and Montgomery Light & Water Power Company, under terms announced some time ago. The remainder will be held for future corporate purposes of the company, and for the payment of the dividends in common stock on Cities Service common stock, according to the recently announced dividend plan.

Manila (P. I.) Electric Railroad and Lighting Corporation.—The uncertainty of the future political status of the Philippine Islands, it is stated in the annual report for 1915, created during the year a widespread condition of unrest. This brought about the almost entire cessation of investment of capital in new enterprises or in already established businesses. Almost all the local industries and business houses followed a policy of retrenchment, causing decreased revenues to the insular and municipal treasuries, which in turn had to resort to the assessment of additional taxes. The government and municipalities also stopped to a great extent all improvements and new public works. The available shipping to and from Manila has been so scarce that all lines of trade have suffered and freight rates have risen so high as to be almost prohibitive.

The comparative consolidated statement of earnings and expenses for 1915 follows:

	1914	1915
Gross earnings	$1,602,001	$1,494,788
Operating expenses and taxes	814,415	762,959
Net earnings	$787,586	$731,829
Interest charges	277,716	264,975
Surplus	$509,870	$466,854

New Orleans (La.) Railway & Light Company.—The company has sold to New York and Philadelphia bankers $3,250,000 of refunding and general lien 5 per cent gold bonds, due in 1949, and $3,250,000 of two-year 6 per cent debenture gold notes. The proceeds of the sale will be used to retire $4,000,000 of 6 per cent debenture gold notes which matured on June 1, and to provide funds for other capital requirements. The bonds are being offered to investors at 92 and interest.

Oro Electric Corporation, Oroville, Cal.—The Oro Electric Corporation and its subsidiary companies, the Oro Water, Light & Power Company, the Oroville Light & Power Company, and the Oroville Water Company, on July 10 filed an application with the Railroad Commission of California, requesting authority to sell their properties to the Pacific Gas & Electric Company. The Oro Electric Corporation distributes electricity in the counties of Butte, Yuba, Amador, Calaveras and San Joaquin, and also distributes water for domestic and irrigation purposes in Butte County and vicinity. The Oro Water, Light & Power Company distributes gas and water in various portions of Butte County, including the city of Oroville. The Oroville Light & Power Company is the owner of a gas plant and system and an electric distributing system in the city of Oroville, its properties being operated by the Oro Electric Corporation and the Oro Water, Light & Power Company. The Oroville Water Company is non-operative. The Pacific Gas & Electric Company in the same application asks for authority to issue general and refunding mortgage gold bonds at 85 in a sufficient amount to net the sum of $1,491 151.35, it having expended or being about to expend this sum in acquiring the bonds of the Oro Electric Corporation, issued under its mortgage of Oct. 1, 1911. All but two of these bonds have been acquired by the Pacific Gas & Electric Company. The reasons given by the Oro Electric Corporation for desiring to dispose of its properties is that it is without sufficient funds to properly develop the same and to complete its hydroelectric projects on Yellow Creek and Mill Creek, the estimated cost of which when completed approximates $8,000,000. At the present time the Pacific Gas & Electric Company is supplying the Oro Electric Corporation with large quantities of electric energy. The Pacific Gas & Electric Company's De Sabla system is closely connected with the water sheds, ditches and reservoirs of the Oro Electric Corporation, and the Pacific Gas & Electric Company believes that it will be able to operate the properties of the Oro Company with but few additions to its present organization.

Potomac Electric Power Company, Washington, D. C.—Speaking of the company in his annual report to the stockholders of the parent company, the Washington Railway & Electric Company, Clarence P. King, the president, says: "While the stockholders of the Washington Railway & Electric Company need no reminder of the fact that their treasury assets for sixteen years included all of the stock of the Potomac Electric Power Company, it is evident that the true situation is not appreciated by many who have no financial interest in the company. This stock was acquired under authority of an act of Congress, dated June 5, 1900, and the far-reaching consequences have been mutually advantageous from the beginning. From the power company's standpoint, it resulted in an electrical load of sufficient quantity to warrant a strictly modern plant and of such a character as to result in a load factor which has greatly reduced the cost of production, and logically the selling price of electric energy. Without the railway load the power company could not have afforded a constant downward revision of prices; and without an advantageous supply of power, the present high efficiency of our street railways system's enormous development which has followed, would have been impossible. One important result is clearly outstanding: While the purchasing power of a nickel has diminished at least 50 per cent in comparatively recent years when invested in ordinary household necessities, it has increased at least 100 per cent when tendered for electric light or street railway transportation in the District of Columbia. And this in the face of a staggering advance in the cost of every item pertaining to the business. During 1915 the Potomac Electric Power Company extended its business in a gratifying way. The increase of connected load for a period of years has been from 386,680 to 1,273,818 16-cp. equivalents; and number of meters installed from 5861 to 27,755. The number of street lamps, both arc and incandescent, in service at the end of the year, was 9317, an increase of 1102 for the year. The total connected load on Dec. 31, 1915, was 63,149.4 kw., an increase of 4373.9 kw., while our total equivalent in 16 cp. was 1,273,618, an increase for the year of 98,308. The total electrical output for the year was 111,082,725 kw.-hr. The peak load for the year was carried by the Benning station, without the necessity of calling upon our auxiliary station at Fourteenth and B Streets N. W., where 6000-kw. generators are held in reserve for operation in case of emergency. However, to meet the requirements of our rapidly increasing business an order has been placed for a 15,000-kw. turbogenerator, which is expected to be in operation by October, 1916. The steam consumption of this new unit is much more economical than that of the present units, and a large saving in coal is anticipated. With this additional installation, the main generating station of the company will have a capacity of upwards of 70 000 electrical horsepower. The past year has witnessed marked advance in the art of electric cooking and heating. Realizing the immense field thus opened for the sale of electric energy, our company established in December a new schedule of rates applicable for cooking and heating only. Already a gratifying development is noted. The reduced rate enables the consumer to cook and heat by electricity in a way far more satisfactory and economical than by any other method."

Texas Power & Light Company, Dallas, Tex.—At a recent meeting of the directors of the company it was voted to increase the capital stock from $12,000,000 to $13,000,000. Preferred to the amount of the increase, $1,000,000, will be issued at once, the proceeds to go toward financing improvements and extensions in all parts of the State. At the present time, it is understood, the company is erecting many miles of high power transmission lines.

New Utility and Industrial Companies

The H. J. Foster Electric Company of Cleveland, Ohio, has been incorporated with a capital stock of $25,000 by H. J. Foster and others.

The Sullivan (Ohio) Light & Power Company has been incorporated with a capital stock of $5,000 by Stowell W. Rice and others.

The Ever-Ready Electric Company of Chicago Ill., has been incorporated with a capital stock of $1,000 by Urie T. Young, Edward F. Holliday and Harold Sternfield.

The Wirt (Okla.) Electric Light & Power Company has been incorporated with a capital stock of $1,000 by R. J. Gray, Mayme Gray and Mike Mikels, all of Wirt.

The Citizens' Light & Water Company of Lockhart, Tex., has been incorporated with a capital stock of $75,000 by E. B. Coopwood, J. P. Cardwell, J. T. Storey and E. A. Masur.

The Marshall (Va.) Electric Company has been incorporated with a capital stock of $2,000. The officers are: Charles F. Ramey, president, and A. W. Utterback, secretary, both of Marshall.

The Benton (Tenn.) Light & Power Company has been organized to supply electricity in Benton. The officers are: J. D. Clemer, president; S. B. McCleary, vice-president, and J. E. Cook, secretary and treasurer.

The Electric Light, Water & Land Company of Waterbury, Conn., has been incorporated with a capital stock of $25,000 by Carmine A. Martino, Domenico Giampetrazzi of Waterbury, and W. F. Stanffer of New Britain, Conn.

The Foster-McDonald Company of Boston, Mass., has been incorporated by Almon Foster, Allan R. McDonald and George L. Weeks. The company is capitalized at $50,000 and proposes to manufacture and deal in electrical supplies.

The McFell Electric Company of San Francisco, Cal., has been incorporated by F. W. Watts, G. P. Watts and J. W. Henderson. The company is capitalized at $10,000 and proposes to manufacture and deal in electric generating machinery and apparatus.

The Motor Compress Sales Corporation of East Orange, N. J., has been incorporated by Charles O. Geyer, Felix R. Smith and Gordon Grand. The company is capitalized at $125,000 and proposes to manufacture and deal in mechanical and electric selfstarters.

The Esty Machine Company of Laconia, N. H., has been incorporated with a capital stock of $100,000 to manufacture machinery, operate water rights and generate electricity. The incorporators are: William Esty, George W. Shurwell, Fred F. Taylor, L. A. Dearth and others, all of Laconia.

Trade Publications

Wire Rope.—An illustrated booklet giving formulas and methods of using wire rope has been issued by John A. Roeblings Sons Company, Trenton, N. J.

Electric Glue Pot.—The Hulbert Electric-Steam Manufacturing Company, San Francisco, Cal., has prepared an illustrated folder on its electrically heated glue pot.

Pulmotors.—The Draeger Oxygen Apparatus Company, 422 First Avenue, Pittsburgh, Pa., has issued a bulletin describing its new type B Pulmotor and its operation.

Electric Furnaces. — The Electric Heating Apparatus Company, 133 East Sixteenth Street, New York, has issued an advance-sheet bulletin on high temperature electric furnaces.

Factory Fire-Alarm System.—The Manhattan Electrical Supply Company, 17 Park Place, New York, has prepared a bulletin entitled, "Fire Alarm Systems for Factory and Other Buildings."

Electric Glue Pot. — The General Electric Company, Schenectady, N. Y., has issued bulletin No. 49,103 describing the uses for glue pots and giving the various types manufactured by this company.

Small Centrifugal Blowers.—Bulletin No. 42,801, published by the General Electric Company, Schenectady, N. Y., describes and illustrates a new type of centrifugal blower, naming the advantages of the apparatus.

Direct-Current Motors.—The Diehl Manufacturing Company, Elizabeth, N. J., has just published Bulletin No. 107 on its Type K direct-current motors and generators provided with steel frames and interpoles.

Boiler Tube Cleaner.—"The Logic of the Dean" is the title of a new twenty-page booklet just issued by the William B. Pierce Company, Buffalo, N. Y., illustrating and describing the Dean boiler-tube cleaner.

Wiring Devices.—The Arrow Electric Company, Hartford, Conn., has brought out Catalog No. 17 entitled, "Wiring Specialties for 1916." The catalog contains 128 pages and lists a number of different types of wiring devices.

Traffic Signals.—The Singer Auto Traffic Signal Company, 1805 South Spring Avenue, St. Louis, Mo., is sending out an attractively illustrated bulletin which contains information on its traffic signal for automobiles.

Electrical Safety Devices.—The Detroit Fuse & Manufacturing Company, Detroit, Mich., has issued a bulletin on electrical safety devices in which are described switches and switch boxes manufactured by this company. Prices are also given.

Electric Clipping Machine.—The Gillette Clipping Machine Company, 129 West Thirty-first Street, New York, has prepared an illustrated bulletin which contains information on its electrically operated Model C electric clipping, grooming and buffing machine.

Heat-Resisting Metal.—"Insuluminum" is the title of bulletin No. 118 issued by the Diamond Power Specialty Company, Detroit, Mich., which contains information on a new metal with high heat-resisting qualities, and the application of the material to the Diamond mechanical soot blower systems.

Electric Washing Machines, Ironers and Vacuum Cleaners.—The Hurley Machine Company, 29 South Clinton Street, Chicago, Ill., has published Catalog C, which is attractively illustrated and which contains information on several types of electric washing machines, combination electric-gas ironing machines and electric vacuum cleaners.

Ventilating and Heating Apparatus.—Illustrations of typical installations of motor driven ventilating and heating apparatus are given in leaflet 1356 which has just been brought out by the Westinghouse Electric & Manufacturing Company. Brief statements of how Westinghouse motors meet the requirements of this service are given.

Automobile Lighting Switches. — Methods of installing Cutler-Hammer automobile lighting switches on various cars are illustrated in a pamphlet recently published by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Phantom views of some of the switches are shown. The latter part of the book is devoted to wiring diagrams for various lighting combinations.

Plugs and Receptacles.—Various designs of interchangeable plugs and receptacles and candle length sockets are described and illustrated in two pamphlets recently prepared by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. The plugs and receptacles are referred to as the standard 7700 line, because they are constructed on specifications agreed to by six manufacturers of electric wiring specialties. The candle length socket is made in one unit.

Arc-Welding.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., recently issued special publication No. 7064 entitled, "Cut Your Repair Cost With Westinghouse Arc-Welding Equipment." In it are described special uses for the arc-welding equipment in railroad shops such as repairing fire-box cracks, welding locomotive flues, filling mud rings and cutting frames. The costs of making repairs by this method are compared with performing the same operation by older methods.

Battery Instructions.—Various instructions for operating and maintaining Exide batteries in automobile starting and lighting service have been issued in pamphlet form by the Electric Storage Battery Company, Philadelphia, Pa. In addition to tables of charging rates, instructions are given on the first care of a new battery, adding water, taking hydrometer readings, general and special charging, requirements for the charging circuit, cleanliness, the care of batteries, and how to locate faulty batteries and repair same. Care of batteries out of service is also touched on.

New England

ST. JOHNSBURY, VT.—The Essex Storage Battery Company, recently incorporated, proposes to develop water power and storage reservoirs on the Moose River and tributaries in Essex and Caledonia Counties. Theodore W. Chase of Passumpsic, Fred D. Gilman and Charles G. Bailey of St. Johnsburry are among the incorporators.

BROCKTON, MASS.—Steps have been taken by the Chamber of Commerce to secure a better lighting system on Main and Centre Streets. The plans provide for the erection of 68 ornamental standards mounted with 1000-cp. nitrogen lamps, the lamps to be furnished by the Edison Electric Illuminating Company of Brockton.

MILBURY, MASS.—The Windle Wool Scouring Company is contemplating the construction of a factory two stories high, and a one-story power house, to cost about $70,000, near the Boston & Albany Railroad division tracks.

WARREN, MASS.—The substation of the Central Massachusetts Electric Company on the Ware road near the Warren town farm was destroyed by fire recently, causing a loss of about $10,000.

NEW BRITAIN, CONN.—The Council has authorized the installation of an ornamental lighting system, to cost about $5,000. The system will be installed by the United Electric & Water Company which furnishes electrical service here.

NEW BRITAIN, CONN.—The United Electric Light & Water Company has acquired right of way for an electric transmission line in the southwestern part of the city. The company expects to erect about 1½ miles of lines along this right of way connecting the substation at Black Rock with the line of the Connecticut Power Company, which will add another source of supply to New Britain in cases of emergency.

WATERBURY, CONN.—The United Electric Light & Water Company of Waterbury has petitioned the Public Service Commission for approval of construction of an aerial cable for the transmission of electricity from New Britain to Berlin.

Middle Atlantic

BROOKLYN, N. Y.—Bids will be received at Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 1 for furnishing asbestos, cement, desk and bracket fans, globes, magnesia blocks, cement and pipe covering, storage battery testing outfits, prismatic reflectors, weatherproof sockets and cotton waste, etc., at the navy yard, Brooklyn, N. Y. For proposal blanks apply to supply officer, navy yard, Brooklyn, or to the above bureau.

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, until July 24 for alterations, fire protection, sanitary, heating, electric work, etc., duplicate school plan, at Public Schools 50, 72, 110, 125, 174 and 175, borough of Brooklyn. Blank forms, plans, etc., may be seen or obtained at the above office and at the branch office, 131 Livingston Street, Brooklyn.

NEW YORK, N. Y.—The Interborough Rapid Transit Company has purchased a site on Jerome Avenue south of Kingsbridge road, on part of which it proposes to erect a transformer station which will supply energy to operate the Jerome Avenue subway and "L" roads and the Webster Avenue "L" extension now under construction.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, until July 24 for general construction, plumbing, heating and ventilating and electric equipment of alterations in and additions to Public School 4, on the corner of Fulton Avenue and East 173d Street, borough of the Bronx. Blank forms, plans, etc., may be obtained at the above office.

NIAGARA FALLS, N. Y.—Plans providing for the development of 2,000,000 hp. of electric energy below the Nigara Falls without disturbing the Horseshooe and American Falls, at a cost of $100.000,000, have been submitted to the Dominion Government by the Thomson-Porter Cataract Company for approval. The company has applied for a Dominion charter with rights to construct in the rapids of the Niagara River below the falls, the Canadian half of an international dam to raise the water 100 ft. and develop 2,000,000 hp. One-half would go to Ontario and the other half to New York. T. Kennard Thomson and Peter A. Porter, both of New York State, are interested in the project.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

OLD CHATHAM, N. Y.—Arrangements have been made whereby the Chatham (N. Y.) Electric Light, Heat & Power Company will extend its transmission lines to Old Chatham to supply electrical service here. The company, it is expected, will extend its service to East Chatham.

PERRYSBURG, N. Y.—An agreement has been reached whereby franchises have been granted to the Silver Creek (N. Y.) Electric Company and the Gowanda (N.Y.) Light & Power Corporation to operate here; one of the companies is to furnish electrical service in the town of Perrysburg and the other in the village of Perrysburg.

RED CREEK, N. Y.—Bids will be received by the Village Trustees of Red Creek until Aug. 10 for construction of water works system, including 4 miles of 6-in. and 8-in. cast iron pipe, etc., pumping station, power pumping machinery and elevated water tank. H. C. Kittredge, German Insurance Building, Rochester, is engineer.

ALLENTOWN,PA.—Contracts have been signed for the installation of the ornamental lighting system on Hamilton Street, between Penn and Twelfth Streets, which provide for the erection of 118 ornamental standards mounted with a 600-cp. lamp. The Lehigh Valley Light & Power Company will install the system and maintain the lamps.

PHILADELPHIA, PA.—Plans have been prepared for the erection of a power house for Hafleigh & Company at American and Somerset streets, Philadelphia. W. E. Dyer is architect.

PHILADELPHIA, PA.—Plans have been prepared by T. Wolstenholme Sons & Company, Frankford Avenue, Philadelphia, for the construction of a power plant, two stories high.

PHILADELPHIA, PA.—The Bell Telephone Company, 1230 Arch Street, Philadelphia, is contemplating the construction of a five-story concrete building and brick warehouuse and office at 950 North Hancock Street.

TITUSVILLE, PA.—Steps have been taken for the installation of an ornamental lighting system on the principal business street of the city. The plans provide for the erection of 60 standards, mounted with 200-watt Mazda type C lamps. The Merchant's Protective Association is to pay for the posts and equipment and the city is to install the system and maintain the lamps.

WAYNE, PA.—Plans are being considered for improvements to the street-lighting system in North Wayne.

GLASSBORO, N. J.—Plans are being prepared by the Whitney Glass Works for the installation of a gas producer power plant. De Vore & McGormley, Nasby Building, Toledo, Ohio, are architects.

MONTCLAIR, N. J.—Bids will be received by Lambert L. Jackson, secretary of the board of education, Montclair, N. J., until July 25 for alterations to the Watchung School, consisting of general construction, plumbing, heating and ventilation and electrical work, separate bids to be submitted the above. Bids will also be received at the same time and place for alterations and additions to the Nishuane School building, now known as the Cedar Avenue School. Separate bids to be submitted on general construction, plumbing, heating and ventilating, and electrical work. Plans and specifications may be obtained at the office of Starrett & Van Vleck, architects, 8 West Fortieth Street, New York, N. Y., upon deposit of $10 for each school.

NEW BRUNSWICK, N. J.—Bids will be received by the Board of Commissioners of the city of New Brunswick, at the Commissioner's Council Chambers, Court House Building, Paterson Street, New Brunswick, until July 25 for lighting the streets of the city for the term of two years and five years as follows: 391, more or less, regular commercial standard 2000-cp. arc lamps; 227, more or less, regular commercial standard, 32-cp. incandescent lamps; 59, more or less, Welsbach gas lamps. Bids will also be received for furnishing 91 20-amp. (compensator) type "C" Mazda lamps, 600 cp., 300 W.; 406 15-amp. (compensator) type "C" Mazda, 400 cp., 300 W. James Mershon is director of parks and public property.

RIDGEWOOD, N. J.—Bids will be received at the office of the board of education, High School Building, Ridgewood, until Aug. 17 for construction of a new high school building, separate bids to be submitted on general contract, plumbing, heating and ventilation work and electrical work. Plans and specifications may be obtained from Tracy & Swartout, architects, 244 Fifth Avenue, New York, N. Y., upon deposit of $50, after July 27.

VINELAND, N. J.—Bids will be received by the Board of Commissioners of the borough of Vineland until Aug. 1 for addition to the municipal electric power plant. For details see proposal columns.

CHESTERTOWN, MD. — Perparations are being made by the Washington Company for the erection of a boiler house, to cost about $10,000. J. T. Bramble, 2 East Lexington Street, Baltimore, is architect.

TAKOMA PARK, MD.—Bids will be received by Ben G. Davis, town clerk, Takoma Park, Md., until July 31 for furnishing and erecting a steel water tank and tower and an internal combustion oil engine to replace one of the gasoline engines in the pumping station. Specifications, etc., may be obtained from Harry Stevens, consulting engineer, Union Trust Building, Washington, D. C.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, United States Army, War Department, Washington, D. C., until July 24 under proposal No. 817 for furnishing 170,000 ft. outside distributing wire. For further information address Charles S. Wallace, captain signal corps, United States Army.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 14 for a combination fire-alarm, watchman's clock and telephone system in the building of the Interior Department offices, Washington, D. C. For details see proposal columns.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Washington, D. C., for furnishing at the various navy yards and naval stations the following supplies: Washington, D. C., Schedule 9900—furnishing and installing two electric elevators; Schedule 9887—miscellaneous rubber gaskets; Schedule 9896—15 2-in. feed water regulators. Brooklyn, N. Y., Schedule 9894— 80 gate valves; Schedule 9891—100 storage battery testing outfits; Schedule 9895—four torsion meters. Newport, R. I., Schedule 9893—fifty gyro wheels; Schedule 9887—20,000 ft. single-conductor wire. Norfolk, Va., Schedule 9897—two motors. Puget Sound, Wash., 9886—miscellaneous telephones. Applications for proposals should designate the schedule desired by number.

North Central

DETROIT, MICH.—The Continental Motor Manufacturing Company is contemplating the construction of a power plant. W. H. Reddig is general manager.

JACKSON, MICH.—Bids will be received by the board of education of the Union School District of the city of Jackson until July 27, for construction of the West Intermediate and the East Intermediate school buildings. Four separate and distinct bids to be submitted for each building as follows: (1) General contract; (2) plumbing; (3) heating and ventilating; (4) electric wiring. Plans for the West Intermediate School may be obtained at the office of Leonard H. Field, Jr., architect, Camp Building; for the East Intermediate School Building at the office of Claire Allen, Dwight Building, architect, both of Jackson, upon deposit of $10. Plans may be seen at the Board of Education, 319 West Main Street.

MOUNT CLEMENS, MICH.—The Detroit Edison Company is contemplating abandoning the local power plant and to transmit electricity from Detroit plant to operate the system here.

MOUNT PLEASANT, MICH.—The plant and holdings of the Consolidated Light & Power Company of Mount Pleasant have been purchased by the Hudson Estate of Detroit. The company has been reorganized under the name of the Central Michigan Light & Power Company of Mount Pleasant. The capital stock is placed at $50,000. The construction of a new dam and other improvements are contemplated in the near future.

ONAWAY, MICH.—The Onaway Electric Light & Power Company is contemplating the construction of a new dam at the site of its present dam on the Black River, near Tower.

PORT HURON, MICH.—Extensive improvements are being made to the plant of the Port Huron Gas & Electric Company, including the erection of a new smoke stack, 175 ft. high, two new boilers and a 2000-kw. turbine. All boilers will be equipped with automatic stokers.

CINCINNATI, OHIO.—The Union Gas & Electric Company has begun work on the construction of its new power plant on the river, to cost about $1,000,000. The contract for the foundation has been awarded to the Foundation Company of New York, N. Y. Contracts will soon be awarded for boiler house, a dynamo building and a concrete intake pier for the water supply.

DESHLER, OHIO.—Bids will be received by the Board of Trustees of the village of Deshler until July 31 for erection of a transmission system to transmit electricity to the village of Deshler and installation of a distribution system, including an ornamental street-lighting system in the village of Deshler. Plans and specifications may be obtained on application to the board.

LAKEWOOD, OHIO.—Bids will be received at the office of the clerk of board of education of the city school district of Lakewood at School Headquarters, High School Building, Lakewood, until Aug. 8 for construction of new high school building, including heating, ventilating and heat control, electric wiring, electric fixtures, elevator, etc. Plans and specifications may be obtained upon application to Charles W. Hopkinson, architect, Rose Building, Cleveland, upon deposit of $20.

SWANTON, OHIO.—The capital stock of the Swanton Light & Power Company has been increased from $10,000 to $20,000.

WASHINGTON C. H., OHIO.—The city authorities are considering a bid submitted by the Washington Gas & Electric Company for street-lighting, including the installation of an ornamental lighting system. About 150 lamps will be installed.

AUBURN, KY.—A movement has been started looking toward the establishment of an electric-light and power plant in Auburn. The Mayor is interested in the project.

LANCASTER, KY.—Steps have been taken toward the construction of a large hydroelectric plant on the Dix River at what is known as Kennedy's Mill, to supply electricity in several cities in central Kentucky, including Lexington, Richmond, Danville, Nicholasville, Lancaster and Harrodsburg. The cost of the plant is estimated at $3,000,000. Louis B. Herrington of Richmond has charge of the work.

LEXINGTON, KY.—Arrangements are being made by Henry Schoonmaker, commissioner of public property, for the installation of 26 high-candle-power incandescent lamps, on standards, in Woodland Park, for which $1,000 has been appropriated.

BLOOMFIELD, IND.—The property of the Home Light & Water Company of Bloomfield, it is reported, has been purchased by the Utilities Development of Chicago, Ill. The latter company is reported to be contemplating acquiring the light and water plants in Worthington, Linton, Oden and Bicknell.

SULLIVAN, IND.—Steps have been taken by the Chamber of Commerce for the installation of an ornamental lighting system in the business district.

WAVELAND, IND.—The Town Trustees have awarded a contract to the Roachdale (Ind.) Electric Light & Power Company to light the streets of the town. The company will erect a transmission line from Roachdale to Waveland. Russellville will be served by the same line.

WESTPORT, IND.—All bids for the municipal electric-lighting system, it is reported, have been rejected. New bids, it is understood, will be received until July 24.

ALBANY, ILL.—Bids will be received by the town of Albany until Aug. 1, for the installation of a local electric distribution system, to cost about $3,500. David G. Fisher & Company, Whitake Building, Davenport, Iowa, are engineers. For details see proposal columns.

BONDVILLE, ILL.—The Bondville Electric Light Company, recently incorporated with a capital stock of $1,500, proposes to supply electricity in Bondville. J. C. Flowers, G. B. Talbot and others are interested in the company.

CHICAGO, ILL.—Plans are being prepared by the Hughes Electric Heating Company of Chicago for the erection of a new factory at Waller Avenue and Taylor Street, to cost about $150,000.

GALESBURG, ILL.—Extensive improvements will be made to the street-lighting system. All wooden poles will be removed from Simmons Street. The city will purchase 200 additional 400-cp. Mazda lamps for which bids have been asked. John Walsh is superintendent of the electric light department.

JACKSONVILLE, ILL.—Bids will be received at the office of J. K. C. Pierson, architect, Ayers Bank Building, Jacksonville, Ill., until July 31 for the erection of a two-story gymnasium building for the Illinois Woman's College at Jacksonville. Separate bids to be submitted on general construction, heating, plumbing and electric wiring. Plans and specifications may be obtained from the architect upon deposit of $15.

MOUNT STERLING, ILL.—The installation of a municipal electric-light plant is being agitated by local citizens. The cost is estimated at about $30,000.

ST. CHARLES, ILL.—Bids will be received by the Board of Administration, Capitol Building, Springfield, Ill., until Aug. 1, for construction of new employes' building at the St. Charles School for Boys, St. Charles. Separate bids will be received on general work, heating, plumbing and electrical work. These bids are in lieu of bids received on May 2, which were rejected by the Board of Administration. Plans and specifications may be obtained upon application to James B. Dibelka, state architect, 130 North Fifth Avenue, Chicago, Ill., upon deposit of $10.

STREATOR, ILL.—Bids will be received at the office of Philip Saunders, clerk of board of education, Peoples Trust and Savings Bank, Streator, until Aug. 2 for construction of the Sherman School building for School District No. 45, Bruce Township. Complete bids will be received on general contract for the building and separate bids will be received on heating, plumbing and electric wiring. Plans and specifications are on file at the office of William G. Foster, architect, Streator, Ill.

EAU CLAIRE, WIS.—Bids will be received by H. M. Knudtson, secretary of Luther Hospital, Eau Claire, until Aug. 8 for construction of a fireproof hospital, separate bids to be submitted as follows: General contract, heating and ventilating, plumbing and gas piping, and electric work. Plans and specifications may be obtained from W. L. Alban, Endicott Building, St. Paul, Minn., upon deposit of $15 for general construction and $10 on each of the other items.

MILWAUKEE, WIS.—The State Railroad Commission has approved of an issue of stock and bonds, aggregating $3,000,000 by the Wisconsin Light, Heat & Power Company of Milwaukee. John I. Beggs is interested in the company.

WHITEHALL, WIS.—Bids will be received by the secretary of the board of trustees of the Trempealeau County Insane Asylum, Whitehall, Wis., until July 26 for the construction of a complete electric-lighting system for the Trempealeau County Insane Asylum. Plans may be seen at the Builders' Exchange in Milwaukee, Wis., Minneapolis and St. Paul, Minn. Copies of plans may be obtained at the office of the trustees at Whitehall.

ARGYLE, MINN.—Bonds to the amount of $18,500 have been voted for improvements to the municipal electric-light plant and water-works system.

BLUE EARTH, MINN.—Bids will be received by the Board of Public Works, Blue Earth, until July 25 for exchange of approximately 485 direct-current electric meters for the same number of alternating-current meters.

BLUE EARTH, MINN.—Bids will be received by Easton Floe, city clerk, until July 25 for furnishing the city of Blue Earth with transformers, lightning arresters, etc. Specifications are on file in the office of the city clerk, Blue Earth, and in the office of Earle D. Jackson, consulting engineer, Capital Bank Building, St. Paul, Minn.

CHOKIO, MINN.—Bids will be received by the independent school district, No. 27, of Stevens County, Chokio, Minn., until Aug. 11 for construction of a fireproof addition and alterations in construction and mechanical equipment in the present school, separate bids to be submitted as follows: General construction, heating and ventilating, plumbing and electrical work. Plans and specifications may be obtained at the office of W. L. Alban, architect, Endicott Building, St. Paul, Minn., upon deposit of $10. Lewis Larson of Chokio is secretary of board.

GIBBON, MINN.—Bids will be received by C. W. Carlson, village clerk, until Aug. 1 for furnishing electricity for lighting the streets and for commercial purposes for a period of ten years.

JACKSON, MINN.—Bids will be received by S. W. Bruce, village recorder, Jackson, until July 26 (readvertisement) for construction of additions and improvements to the municipal electric-light plant as follows: (1) Brick and tile building; (2) electric station equipment, consisting of one 72-in. by 18-in. fire tube boiler set in battery with an old boiler, one concrete chimney, 150-kva. generating unit, consisting of engine and generator, addition to switchboard, etc.; Minnesota piping connections therefor; constant-current transformers for street lighting; furnishing and erecting one 150-gal. motor-driven pump for water-works, including piping connections. Bids will be received only on complete parts. Plans and specifications are on file in the office of the village recorder and in the office of Earle D. Jackson, Capital Bank Building, St. Paul, consulting engineer.

ORTONVILLE, MINN.—The Otto Tail Power Company of Fergus Falls is contemplating extending its transmission lines to Ortonville to supply electricity here.

SANDBORN, MINN.—The local electric-light plant, owned by Nordgren & Dahlgren, was recently destroyed by fire.

BLAIRSBURG, IOWA.—The City of Blairsburg has granted the Iowa Falls (Iowa) Electric Company a franchise to supply electricity here for commercial purposes.

CUMBERLAND, IOWA.—Bids will be received by C. P. Shearer, secretary of the board of education of the independent school district of Cumberland, Iowa, until Aug. 14 for the construction of a school building according to plans and specifications prepared by Reimer & Herlin, architects, Marshalltown, Iowa. Separate bids to be submitted on general work, heating and plumbing, and electric wiring. Plans may be seen at the office of the architect and the secretary of the board of education after July 29.

GRINNELL, IOWA.—Bids will be received by W. G. Ray, secretary of the board of education, of the independent school district of Grinnell until July 28 for construction of grade school building, separate bids to be submitted on general construction, heating and plumbing, and electrical wiring. Plans and specifications are on file at the above office and in the office of Reimer & Herlin, architects, Marshalltown, Iowa.

HUMBOLDT, IOWA.—The Northern Iowa Gas & Electric Company, recently organized with a capital stock of $6,500,000, is serving several communities with electricity and gas in the north central portion of Iowa, including Humboldt, Dakota, Eagle Grove, Clarion, Sheldon, Luverne, Corwith, Kanawha and Pocahontas, and has more recently purchased the properties at Sioux Rapids and Forest City. The generating plants operated by the company include a water power plant on the Des Moines River at Humboldt and auxiliary steam plants at Humboldt, Clarion and Eagle Grove, and also steam plants at Sheldon and Forest City, not connected with transmission lines. The company has in operation at present about 160 miles of transmission lines, and its plans provide for extension of these lines into Hancock, Kossuth, Palo Alto, Clay and O'Brien Counties, in addition to the present counties served. The headquarters of the company are in Humboldt.

LE GRAND, IOWA.—Bids will be received by Charles G. Johnson, secretary of board of education, of the independent consolidated school district of Le Grand, Iowa, until July 31 for construction of school building, separate bids to be submitted on general construction, heating and plumbing, and electric wiring. Plans and specifications may be seen at the office of Reimer & Herlin, architects, Marshalltown, Iowa.

MAQUOKETA, IOWA.—The local electric-light plant, it is reported, has been taken over by the Iowa Railway & Light Company of Cedar Rapids and will extend its transmission lines to this city. Steel poles and towers will be used for the new line.

CHAFFEE, MO.—Bids will be received by the Mayor and Board of Aldermen of Chaffee, Mo., until July 28 for construction of water-works and sewer system. Bids to be submitted separately. The water-works consists of approximately 3½ miles of 4 to 8-in. cast-iron water pipe, 22 hydrants, 24 valves with boxes, tower and tank and pumping station with oil-engine-driven triplex pump. Plans and specifications may be obtained from Frank L. Wilcox, engineer, Syndicate Trust Building, St. Louis, Mo., upon deposit of $5.

KANSAS CITY, MO.—The Kansas City Electric Light Company has applied to the county court for general permission to use the highways of the county for the purpose of erecting electric light poles, running conduits and feed lines.

WINNER, S. D.—The electric franchise granted to Floyd Hunt has been taken over by E. L. Snyder. Work on the new plant, it is understood, will soon begin.

HOLBROOK, NEB.—Bids will be received by the city of Holbrook until July 27 for

construction of electric-light plant, to cost $8,870. The equipment will include two 25-hp. oil engines, two 15-kw., direct-current generators, storage batteries, switchboard, distribution system, oil storage tanks and street lamps. S. F. Davis is city clerk; Grant & Fulton, Bankers Life Building, Lincoln, are engineers.

OMAHA, NEB.—General contract has been awarded for construction of a six-story building, 100 ft. by 200 ft., to cost $225,000, in connection with an ice plant, cooler and dock for Armour & Company at Twenty-eighth and Q streets. Steam heating, electric wiring, refrigerating apparatus, boilers, etc., not yet decided upon. Plans were prepared by Frank P. Gould & Son, City National Bank Building, Omaha. R. S. Howe is general manager.

ABILENE, KAN.—The Riverside Light, Power & Gas Company of Abilene has closed contracts for furnishing electricity in 15 more towns in central Kansas, making a total of 21 municipalities served. Work is now progressing on the erection of 96 miles of transmission lines. The Riverside company will build systems in the towns of Ramona, Lincolnville, Lost Springs, New Cambria, Manchester, Longford, Wakefield, Detroit and Talmage.

HANOVER, KAN.—The Hanover Light & Power Company, recently incorporated, contemplates furnishing electrical service in Hanover. A. J. Hopkins, Henry B. Collier and others are interested in the company.

LEWIS, KAN.—An election will be held July 26 to vote on the proposal to issue bonds for the erection of a transmission line from Kinsley to Lewis and a distribution system in this city. The previous election was held to be illegal.

OLATHE, KAN.—The bond issue of $50,000 recently voted for the construction or purchase of a municipal electric-light plant has been declared illegal by the attorney-general of Kansas. Another election will soon be called to submit the bond issue to the voters again.

TOPEKA, KAN.—The Commonwealth Utilities Service Company of Colorado, chartered to do business in Kansas, has petitioned the Public Utilities Commission for permission to take over the property of the Manhattan (Kan.) Ice, Light & Power Company, and the three companies of Junction City, as follows: Rocky Ford Mill & Power Company, the Raber-Pierce Electric Company, and the Blue River Power Company. All the companies are closely associated.

Southern States

HICKORY GROVE, S. C.—The installation of an electric-lighting plant in Hickory Grove is under consideration. J. S. and S. C. Wilkerson are interested in the project.

GAINESVILLE, GA.—The Georgia Railway & Power Company of Atlanta, has purchased the property of the Gainesville Railway & Power Company, consisting of 8 miles of street railway in Gainesville, 2 miles of lines to Gainesville suburbs, the electric-lighting system in this city and a hydroelectric plant on the Chestatee River, developing 1500 hp., for about $180,000.

PLANT CITY, FLA.—Roscoe Nettles of Tampa has applied for a franchise to construct an electric light and gas plant in Plant City.

MARYLAND, TENN.—The Mountain Lake Land Company is planning to install an electric plant (water power) to supply electricity for a summer resort. P. D. Houston, 329 Union Street, Nashville, is president.

MEMPHIS, TENN.—The City Commission and the Merchants' Power Company and the Consolidated Gas & Electric Company having failed to come to an agreement as to the rates for electrical service, it is expected that the city will take steps toward the construction of a municipal electric plant. Frederick W. Ballard of Cleveland, Ohio, is consulting engineer.

ASHLAND, ALA.—The Alabama Power Company of Birmingham is planning to erect a transmission line from Ashland to Lineville and from Huntsville to Gurley.

GREENSBORO, ALA.—The Hale Light & Power Company, recently incorporated with a capital stock of $10,000, contemplates operating electric-light and power plants in Greensboro and elsewhere. E. P. Kimbrough, Greensboro, is president.

THOMASVILLE, ALA.—The Thomasville Manufacturing, Electric Light & Power Company is contemplating the installation of an additional engine and some extensions to its transmission lines.

FAYETTEVILLE, ARK.—The Fayetteville Gas & Electric Company is contemplating the erection of 1½ miles of transmission line to supply 225 kw. to operate a wood-working plant. Transformers, arresters, switching apparatus and line material will be required. As yet nothing definite has been decided upon. F. L. Oneal is superintendent.

HELENA, ARK.—The Helena Gas & Electric Company expects to install in the near future an ornamental street-lighting system, consisting of 60 ornamental standards mounted with four 75-watt, type "C" and one 100-watt, type "C" lamps. W. J. O'Brien is general manager.

MIAMI, OKLA.—The installation of an electric-light plant and water-works system in Miami is under consideration.

MUSKOGEE, OKLA.—The Muskogee Electric Traction Company, it is reported, is contemplating building a power plant to operate its system. The proposed plant will develop from 500 to 700 hp. and cost about $100,000. The company now purchases energy from the Muskogee Gas & Electric Company..

RINGLING, OKLA.—The citizens are considering offering a franchise to a private company to install and operate an electric-light plant in Ringling in case the Southwestern Public Service Company does not install a lighting system soon. The company has a franchise to install a natural gas plant.

AUSTIN, TEX.—Bids will be received by Captain J. A. Owens, superintendent of public buildings and grounds, Austin, until July 31 for remodeling and repairing State power house in Austin. Plans and specifications may be obtained from the office of Atlee B. Ayres, state architect, 626 Bedell Building, San Antonio, Tex.

AUSTIN, TEX.—In connection with the present work of rewiring the State Capitol building an electric call system for pages and messengers in the House of Representatives and the Senate is being installed. About $20,000 will be expended in rewiring the Capitol building. A. M. Vaugh of Dallas, electrical engineer, has been engaged by the State to supervise the new wiring system.

DALLAS, TEX.—The Texas Power & Light Company of Dallas is contemplating extensive extensions to its electric transmission system, and also the erection of an additional generating station in Austin. The company recently filed an amendment to its charter increasing its capital stock from $13,000,000 to $14,000,000.

ROCKDALE, TEX.—The village of Rockdale has granted the Texas Power & Light Company of Dallas a franchise to construct and operate an electric-light plant here.

SHINER, TEX.—The city of Shiner has taken over the local electric plant, owned by F. A. Pagel, Sr., and will make extensive improvements to the system. Improvements will also be made to the municipal water-works.

WACO, TEX.—The City Commission has awarded a contract to the Texas Power & Light Company for the installation of ornamental street lamps for a distance of six blocks on Austin Street.

Pacific States

CHENEY, WASH.—A petition is being circulated in Cheney asking the Merchants Central Heating Company of Spokane, now known as the Spokane Heat, Light & Power Company, to extend its electrical service to Cheney. The city is now served by the Washington Power Company of Spokane, but its rates are considered too high.

DEMING, WASH.—The Puget Sound Traction, Light & Power Company, Bellingham division, is planning to erect a substation in Deming at once to serve the town and nearby ranchers with electricity. The initial installation will provide for 150 hp., which will ultimately be increased to 450 hp. and the transmission lines extended to adjacent neighborhoods.

STANWOOD, WASH.—The City Council has granted a franchise to Warner Marshall of Boston, Mass., to supply electricity for lamps and motors in Stanwood for a period of 50 years. Mr. Marshall has been granted a similar franchise in the city of Arlington, near here. It is understood that he will take over the power plants in both cities. According to reports energy will be obtained from Jim Creek near Arlington and a transmission line will be extended down the valley to Stanwood. The company will furnish the towns of Silvana, Norman and Florence with electricity, as well as the ranches between Stanwood and Arlington. A contract for street-lighting has been entered into with the city of Stanwood. The new owner will reconstruct the local plant and system.

MYRTLE CREEK, ORE.—An election will soon be held to submit to the voters the proposal to issue bonds for improvements to the municipal electric-light plant. Plans for the proposed improvements are being prepared by M. D. Germond, engineer, of Redmond.

SUMPTER, ORE.—The electric substation at the Ben Harrison mine was recently destroyed by fire, causing a loss of about $9,000. The station, it is understood, will be rebuilt at once.

THE DALLES, ORE.—In his message to the City Council Mayor Anderson advocates the installation of a municipal electric plant unless satisfactory arrangements can be made with the Pacific Power & Light Company for lighting the city.

DUNNIGAN, CAL.—The Northern California Power Company of San Francisco has been granted a franchise to extend its transmission line from College City to Dunnigan and to furnish electricity in Yolo County and all the portion of Yuba County not now served by the Pacific Gas & Electric Company.

FRESNO, CAL.—Bids will be received by the Board of Supervisors of Fresno County, Fresno, until Aug. 8 for the installation of an electrolier lighting system in the Court House Park. D. M. Barnwell is clerk of board.

SAN FRANCISCO, CAL.—The merchants and property owners on Kearney Street and the triangle business district have given their approval of the new lighting system, which is similar to the one planned for Market Street. The plan provides for the substitution of new standards for the electroliers now in use. Each standard will carry one luminous arc lamp and two incandescent lamps, all fitted with the new San Francisco Carrara glass.

TERRY, MONT.—Charles Boulter of the Terry Light & Power Company has sold his interest in the Terry electric plant to L. H. Gaffney. Some alterations and extensions, it is understood, will be made to the plant.

WHITETAIL, MONT.—Preparations are being made by C. E. Warwick of Anaconda, Mont., for the installation of an electric-light plant in Whitetail.

LOUISVILLE, COL.—The Commercial Association is interested in a project to establish a power plant in Louisville.

CARLSBAD, N. M.—The Carlsbad Light & Power Company will soon begin work on the installation of new machinery at the Tansil Dam power house and the erection of transmission line to supply electricity for lamps and motors in Carlsbad and vicinity. A 125-kva. vertical three-phase alternating-current generator directly connected to a vertical waterwheel, under a 14-ft. head, with exciter, waterwheel governor, voltage regulator and switchboard will be required and also material for pole line. The company will also handle all kinds of electrical devices and do a general wiring business. S. B. Richey is resident manager.

Canada

PEACE RIVER, OLTA.—Plans have been prepared by W. D. Cromarty, University of Alberta, Edmonton, for the installation of an electric generating plant at Peace River. For further information address R. C. Desrochers, secretary of department of public works, Otawa, Ont.

ORILLIA, ONT.—The Town Council has awarded the contract for hydraulic equipment for the Swift Rapids power plant to the Boving Hydraulic & Engineering Company of Lindsay, at a cost of about $140,000.

ASSINIBOIA, SASK.—Tenders will be received by J. R. Nolan, secretary-treasurer, Assiniboia, until Aug. 8 for furnishing one 150-hp. internal combustion engine, generator, exciter, switchboard and other apparatus; poles, wire and line material. Plans and specifications may be obtained from Murphy & Underwood, Saskatoon, consulting engineers.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Aug. 7 for structural steel, steel plates, planished iron, post-hole diggers, electrical material, gage lamps, drafting instruments, etc. Blanks and general information relating to this circular (No. 1065) may be obtained at the above office and at the offices of the assistant purchasing agents 24 State Street, New York, N. Y.; 614 Whitney Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

1,189,947. CONTROLLER FOR ELECTRIC MOTORS; C. T. Henderson, Milwaukee, Wis. App. filed Oct. 28, 1913. Provides for both field and battery commutation.

1,189,956. COMBINATION SWITCH LOCK; J. H. Jeffries, Inglewood, Cal. App. filed Sept. 20, 1915. For ignition circuits.

1,189,960. INSULATING BUSHING; J. B. Johnson, Laurel, S. D. App. filed April 30, 1914. For passing a wire through a wall.

1,189,994. GAS DEVICE; E. C. Obermeyer, Nesses City, Mich. App. filed March 11, 1916. Ignites gas when valve is turned on.

1,189,996. INCANDESCENT ELECTRIC LAMP; J. A. Orange, Schenectady, N. Y. App. filed April 19, 1913. Filament mounted at ends of long supporting reflectory leads.

1,189,997. MOTOR; M. Osnos, Berlin, Germany. App. filed Dec. 24, 1913. For electric locomotives operated from rectifier's systems.

1,190,018. ELECTRICAL STARTING DEVICE; J. L. Schureman and C. J. Anderson, Chicago, Ill. App. filed Jan. 21, 1910. At no time does the shaft operate against the load of all the switches.

1,190,025. BATTERY SEPARATOR; J. M. Skinner, Philadelphia, Pa. App. filed Dec. 31, 1914. Wooden plate with laminations at right angles to its plane.

1,190,032. AUTOMATIC ELECTRIC SWITCH; S. S. Stahl, Connellsville, Pa. App. filed Nov. 27, 1915. Swinging arm flexibly connected with switch blades.

1,190,041. ELECTRIC SWITCH INDICATOR; G. B. Thomas, Bridgeport, Conn. App. filed June 4, 1913. For pull socket switches.

1,190,048. DYNAMO ELECTRIC MACHINE; H. Treitel, Charlotteberg, and K. Sulzerger, Berlin, Germany. App. filed Sept. 23, 1914. Provides for only local circulation of air within the machine.

1,190,053. ALARM FOR PAPER MAKING MACHINES; W. Westcott, Watertown, N. Y. App. filed Sept. 23, 1914. Indicates break in the paper.

1,190,054. INDUCTION MOTOR; J. B. Ward, Lynn, Mass. App. filed Jan. 20, 1915. Has annular laminations.

1,190,060. ELECTRIC SWITCH; G. Wolff, Hermsdorf, near Berlin, Germany. App. filed June 4, 1913. Overload circuit breaker latch construction.

1,190,061. THERMOSTAT; J. J. Wood, Fort Wayne, Ind. App. filed June 25, 1914. Quick acting for heavy currents.

1,190,066. ELECTROMAGNETIC RELAY; A. P. Young, Kenilworth, and A. H. St. C. Watson, Coventry, England. App. filed May 21, 1915. Plurality of armatures.

1,190,086. TELEPHONE CIRCUIT; A. E. Beachum, Polkton, N. C. App. filed May 20, 1914. Transmitter of increased efficiency.

1,190,090. ELECTRIC FLASH LAMP; C. A. Bennett, Galt, Cal. App. filed Oct. 16, 1915. Applied to top of ordinary dry cell.

1,190,103. SWITCH; J. R. Byrne, Schenectady, N. Y. App. filed Nov. 12, 1913. Key switch with snap action.

1,190,104. X-RAY TUBE; C. E. Campbell, Lynn, Mass. App. filed April 5, 1913. Target support and heat dissipation.

1,190,115. SPEED-LIMITING DEVICE FOR MOTOR-DRIVEN VEHICLES; O. W. Compton, Independence, Kan. App. filed May 6, 1915. Cuts off motor at predetermined speed of travel.

1,190,120. ELECTRICAL WINDING; E. E. F. Creighton, Schenectady, N. Y. App. filed Nov. 25, 1914. Delays building of high voltage in transformers.

1,190,122. ELECTROLYTIC CELL AND THE PROCESS OF ELECTROLYZING METAL; C. Dantsizen, Scotia, N. Y. App. filed March 20, 1915. Obtaining magnesium in large glasses.

1,190,135. MEANS FOR PREVENTING CORONA LOSSES; G. Faccioli, Pittsfield, Mass. App. filed April 27, 1911. Plurality of insulating connected in multiple.

1,190,140. PROTECTIVE DEVICE; J. J. Frank, Pittsfield, Mass. App. filed June 16, 1913. For transformers.

1,190,143. SWING TRUCK; C. H. Gaskill, Philadelphia, Pa. App. filed Dec. 6, 1915. Extended wheelbase for curves of small radius.

1,190,150. SPEED CONTROL OF DIRECT-CURRENT MOTORS; H. V. Green, Chicago, Ill. App. filed May 27, 1914. Holds speed constant.

1,190,156. SUBMARINE TELEGRAPHY OR TELEPHONY; W. Hahnemann, Kiel, Germany. App. filed Feb. 17, 1913. Involves submerged electrodes.

1,190,157. ELECTRICAL INSTRUMENT; C. I. Hall, Fort Wayne, Ind. App. filed Sept. 14, 1914. Current demand indicator.

Record of Electrical Patents

Notes on United States Patents issued July 11, 1916, prepared by Mitchell & Allyn, 41 Park Row, New York.

1,190,159. ARC LAMP; C. A. B. Halvorson, Jr., Lynn, Mass. App. filed Sept. 16, 1914. Novel outer globe and support.

1,190,162. METHOD OF PRODUCING A FLAMING OR LUMINOUS ARC; J. L. R. Hayden, Schenectady, N. Y. App. filed April 25, 1911. One electrode gives vapors for arc and the other gives steady vapors.

1,190,167. AUTOMATIC CONTROL FOR FLASH BOILERS; G. H. Hill, Schenectady, N. Y. App. filed May 25, 1915. Controls temperature on flow of water.

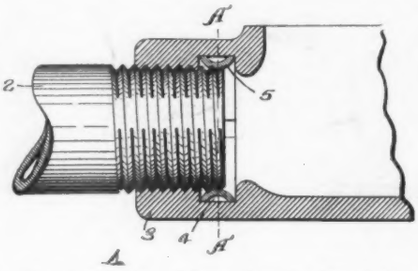
1,190,175. IGNITION SYSTEM; C. F. Kettering, Dayton, Ohio. App. filed March 4, 1912. Advancing and retarding mechanism.

1,190,176. ILLUMINATED SIGN OR ELECTROGRAPH; E. J. Kingsbury, Juneau, Alaska. App. filed Dec. 29, 1914. Single machine plurality in monogram units.

1,190,185. AUTOMATIC TELEPHONE SYSTEM; T. G. Martin, Chicago, Ill. App. filed Aug. 11, 1913. Operating relays and magnets connected with a battery.

1,190,189. ELECTRIC SWITCH; G. B. Pilkington, Waterbury, Conn. App. filed Sept. 9, 1915. Operates by pinching two buttons together.

1,190,190. CARBON CONTACT HOLDER; C. M. Proctor, Detroit, Mich. App. filed March 16, 1914. Clip construction for holding contact button or bell, etc.



No. 1,190,641. Connection for Electric Conduits

1,190,205. THERMOSTAT; I. E. Storey, Los Angeles, Cal. App. filed March 3, 1914. Convaco-convex expansible plate.

1,190,207. BELL-SOUNDING MECHANISM; F. Williams, Somerville, Mass. App. filed May 10, 1913. For schools.

1,190,208. METHOD OF MAKING WELDS WITH PIECES OF COATED METAL AND PRODUCT THEREOF; W. E. Williams, Chicago, Ill. App. filed Sept. 8, 1913. Spot-welding galvanized iron to black iron.

1,190,243. SPEED GOVERNOR FOR ELECTRIC MOTORS; H. J. McMahan, Monessen, Pa. App. filed Dec. 5, 1911. Governs electric motor operation.

1,190,244. CONTACT BREAKER DEVICE FOR ELECTROMAGNETIC VIBRATING MEMBERS; A. H. Maitre and V. H. G. Martin, Rouen, France. App. filed March 7, 1914. Embodies a breaking disk.

1,190,247. RAILWAY SIGNALING SYSTEM; H. A. Wagner, Short Hills, N. J. App. filed June 11, 1908. In connection with semaphore system.

1,190,259. TELEGRAPH KEY; R. M. Allen, E. Orange, N. J. App. filed May 29, 1914. Semi-automatic.

1,190,286. INSULATOR; E. Harlan, Fresno, Cal. App. filed Jan. 12, 1914. Has two bearing points for the tie wire.

1,190,289. ELECTRIC WATER HEATER; A. Herz, Chicago, Ill. App. filed May 24, 1915. May heat part only or entire circulatory system.

1,190,291. METHOD OF AND APPARATUS FOR VARYING THE SPEED OF ELECTRIC METERS ON REVERSAL OF CURRENT FLOW; J. H. Hodde, Springfield, Ill. App. filed Nov. 1, 1912. Lugs slower on charging of battery than on discharge.

1,190,295. AUTOMATIC GAS LIGHTER; B. F. Keith, Belton, Tex. App. filed Feb. 4, 1915. Attachable to ordinary automobile gas lamps.

1,190,297. LIGHTING SYSTEM FOR ELECTRICALLY PROPELLED VEHICLES; D. Kinniburgh, Chicago, Ill. App. filed Dec. 14, 1914. Lowering of trolley pole in entering tunnel throws lighting switch.

1,190,298. SPEED INDICATOR; F. S. Kirk, Enid, Okla. App. filed July 24 1915. Gives alarm when vehicle exceeds predetermined speed.

1,190,304. AMPERE HOUR METER; R. C. Lanphier, Springfield, Ill. App. filed Nov. 16, 1911. For use on discharge of storage batteries.

1,190,308. INCANDESCENT LAMP SOCKET; R. M. Levy, New York, N. Y. App. filed Nov. 24, 1914. For detecting break in series-connected lamps.

1,190,332. ELECTRIC SOUND PRODUCER; M. L. Severy, Arlington Heights, Mass. App. filed Feb. 18, 1907. Telephonic music.

1,190,359. ELECTRIC SWITCH; C. J. Zigler and W. P. Holden, Chicago, Ill. App. filed Feb. 14, 1914. Twisted contact blades.

1,190,366. AUTOMATIC CIRCUIT CONTROLLER; R. D. Ashley, Oakland, Cal. App. filed Aug. 9, 1915. Varies resistance on abnormal fluxation.

1,190,405. BATTERY BOX; C. M. Hattenberger, Kettle River, Minn. App. filed July 27, 1915. Cells automatically connected.

1,190,412. ELECTRODE FOR DEVICES FOR VARYING ELECTRICAL RESISTANCE; W. G. Hudson, New York, N. Y. App. filed Feb. 19, 1914. Tungsten filament with cover of tantalum.

1,190,447. HOT POINT PEN; R. W. Munger and A. E. McGinley, Tacoma, Wash. App. filed Oct. 26, 1914. Side members of larger cross-section than the cross member.

1,190,481. ELECTRICAL TRANSFORMER; G. W. Terhorst, Pittsburgh, Pa. App filed Aug. 29, 1912. Has projections for securing the windings.

1,190,485. ELECTRIC METER; M. E. Turner, Cleveland, Ohio. App. filed June 16, 1910. Attachment for indicating maximum integrated current demands.

1,190,490. ELECTROTHERAPEUTIC APPARATUS; W. L. Walter, Pueblo, Col. App. filed Nov. 7, 1914. For intermittently administering energy to patient.

1,190,502. SUPPORT; R. Anderson, Racine, Wis. App. filed Jan. 21, 1916. For holding a lamp supporting arm in different positions.

1,190,524. TERMINAL CONNECTOR; H. A. Douglas, Bronson, Mich. App. filed Aug. 5, 1913. For coupling cord sections.

1,190,525. TERMINAL CONNECTOR; H. A. Douglas, Bronson, Mich. App. filed Aug. 5, 1913. Simple means for securing of wire ends.

1,190,526. ELECTRICAL CONTACT DEVICE FOR TRAIN COUPLINGS; V. S. Durbin, St. Louis, Mo. App. filed July 5, 1912. Made preliminary engagement.

1,190,534. TROLLEY REPLACER; H. H. Fisher and W. C. Barnes, Evansville, Ind. App. filed Sept. 13, 1915. Automatic in operation.

1,190,548. TELEPHONE RECEIVER; W. W. Henry, Wollaston, Mass. App. filed May 3, 1915 Flexible but has no exposed cord.

1,190,570. SPARK INTENSIFIER FOR SPARK PLUGS; G. R. Meissner, Albia, Iowa. App. filed Oct. 16, 1914. Has adjustable screw electrodes.

1,190,588. RELAY; W. E. Rogers, Trenton, Mich. App. filed March 8, 1913. Retarding device for armature.

1,190,608. BUZZER; R. I. Utter, Chicago, Ill. App. filed Sept. 8, 1914. Fine link chain serves in place of ordinary contacts.

1,190,610. WELDING; J. G. Wallace, Philadelphia, Pa. App. filed Feb. 16, 1915. Metallic rods and wooden spacing blocks between plates.

1,190,621. BREAKSWITCH; G. E. Barstow, Lynn, Mass. App. filed Oct. 16, 1909. Meeting faces brought in flat square contact.

1,190,625. TELEGRAPH KEY; W. A. Boyd, Brooklyn, N. Y. App. filed May 29, 1914. Two pivoted levers movable by a floating key lever.

1,190,641. CONNECTION FOR ELECTRIC CONDUITS; E. E. Greaves, Syracuse, N. Y. App. filed July 25, 1912. Packing ring makes a tight joint.

1,190,647. ELECTROMAGNET; E. Hedenskoog, Muskegon, Mich. App. filed Feb. 28, 1916. For setting pins in bowling alleys.